# Chapter 3. Affected Environment

The affected environment describes those portions of the natural and human environment that could be affected with the implementation of either of the action alternatives.

The South Deep Creek watershed contains landforms representative of the Northern Glaciated Mountains. More specifically, the watershed is within the Selkirk Mountain Range. Elevations in the watershed range from 1,948 feet (where the South Fork joins the North Fork) at the mouth to 5,777 feet near Mount Rogers. Slopes range from 1% to 75% across the watershed.

The mean values for the Northern Glaciated Mountains Ecological Reporting Unit displayed in Table 2.16 in the *Interior Columbia Basin Ecosystem Assessment, Volume I*, indicate that mean annual precipitation is about 34 inches, with a summer mean of 6 inches and a winter mean of 10 inches. Generally an average of 60% of the precipitation occurs as snow.

Approximately 66% (33,257 acres) of the South Deep Watershed was burned by wildfires in 1920's.

Most of the higher elevations and steeper terrain in the southern portion and eastern half of the watershed are part of the Colville National Forest. Sixty-five percent of the watershed is public land, the majority (59%) of which is within the bounds of the Colville National Forest. Federal administration of public land, including both National Forest System and Bureau of Land Management land, accounts for approximately 60% of the watershed.

The Washington Department of Natural Resources owns 5% of the watershed, making it the second largest public land manager.

Roughly half of private ownership is composed of industrial timber lands, while the other half is private residences and ranches. Much of the valley bottom along South Deep and lower Rocky Creeks is owned by rural residents and used primarily for farming and livestock grazing. Most of the northwestern portion of the watershed west of the Aladdin Highway is industrial forest land owned by Boise Cascade Corporation. Other timber companies that own land in the watershed are Arden Tree Farms Incorporated, Vaagen Brothers Lumber Company, and Riley Creek Lumber Company.

# 3.1 The Physical Environment

## 3.1.1 Soil Resources: Affected Environment

Soils on the Colville National Forest formed mainly from glacial till, outwash, lake deposits, colluvium and alluvium[1]. Tills and outwashes can be influenced by a variety of rock types from the complex local geology. In addition, there is a mantle or admixture of volcanic ash which is present over much of the Forest. The thickness of the volcanic ash mantle is variable; the mantle can be several feet thick in some areas. Steeper south and west aspects normally have less ash deposition. The geologically recent glacial deposits have resulted in relatively undeveloped soils, primarily inceptisols[2], on forested sites. The main type of vegetation on south and west aspects is grasses, and the soils have a dark surface layer with higher base saturation (mollisols). The ashy surface mantle has important management implications because it provides an excellent

[1] Sediment deposited by flowing water, as in a riverbed, flood plain, or delta.

[2] Soils of humid and subhumid regions that have altered horizons that have lost bases or iron and aluminum but retain some weatherable minerals. They do not have an illuvial horizon enriched with either silicate clay or with an amorphous mixture of aluminum and organic carbon

medium for plant growth. Ash also has a higher water holding and cation exchange capacity compared to glacial deposits. Undisturbed, it is porous with weak, granular or blocky structures and minimal erosion. However, it is highly subject to erosion if disturbed. These soils are also easily compacted when moist. Additionally, forested sites have a thin "A" horizon that contains the bulk of the organic matter and nutrients in the soil. The ashy surface soil layers have generally increased the productivity potential of soils in glaciated areas. Compaction and displacement of the ashy surface soil layers would reduce site productivity potential and increase the risk of run-off and erosion. Glacial tills beneath the ash mantle are sometimes compacted, which may limit root penetration and may contribute to windthrow of trees with shallow root systems (Williams et al. 1990).

Soils in the South Deep planning area are organized into four general groups: soils on mountains, soils on foothills, soils on terraces, and soils on floodplains. These groups have common patterns of soils, relief, and drainage and are named for the major soils in each category.

Soils on mountains are primarily located on Gillette Ridge along the western boundary of the analysis area. These soils are characterized by the Huckleberry-Raisio-Hartill group. These soils range from shallow to moderately deep. They are well drained soils formed in material weathered from shaly rock and are mantled with volcanic ash and loess[3]. Huckleberry-Raisio-Hartill soils cover 4,744 acres (9%) of the analysis area.

Soils on foothills occupy the majority of the area and are characterized by two map units: the Aits-Newbell-Donavan unit, and the Belzar-Smackout-Maki unit. The Aits-Newbell-Donavan group are very deep, well-drained, nearly level to very steep soils formed in mixed glacial till, with a mantle or admixture of volcanic ash and loess. Aits-Newbell-Donavan soils cover 32,843 acres (65%) of the analysis area. Belzar-Smackout-Maki soils are moderately deep and very deep, well drained, nearly level to very steep soils formed in glacial till from shaly rock and residuum and colluvium[4] from limestone, with a mantle or admixture of volcanic ash and loess. Belzar-Smackout-Maki soils cover 1,087 acres (2%) of the analysis area.

Soils on terraces are distinguished by the Bonner-Eloika-Scrabblers soils group. These are very deep, well drained, and nearly level to very steep soils formed in glacial outwash of mixed mineralogy and are mantled with volcanic ash and loess. They are located along the terraces and terrace escarpments at the mouth of Rocky Creek. Bonner-Eloika-Scrabblers soils cover 1,844 acres (4%) of the analysis area.

Colville-Peone-Narcisse soils occupy the floodplains along the mainstem of the South Fork of Deep Creek. These soils cover less than 1% of the analysis area.

The following soils combine to make up the remainder of the analysis area (8.1%): Ahren, Borosaprists, Bossburg, Bridgeson, Chamokane, Clayton, Eloika, Histosols, Kegel, Manley, Martella, Merkel, Mobate, Narcisse, Raisio, Rathdrum, Spokane, Waits, and Xerochrepts.

# Management Guidelines

Forest Plan soil standards require that:

- the total acreage of all detrimental soil conditions should not exceed 20% of the total acreage within the activity area including landings and system roads;
- skid trail standard practices must be specified in timber sale contracts that include tractor yarding;
- areas of high soil erosion or mass failure potential must be identified and evaluated to determine probable impacts of resource development;

[3] A ` pale, yellowish silt or clay forming finely powdered, usually wind-borne deposits.
[4] A loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.

- and organic matter must be maintained to retain site productivity.

In addition, the 1999 USDA Office of the Inspector General's review of Forest Service Timber Sale Environmental Assessment Requirements stated that critical or sensitive soils must be identified. Critical soils are soils that are highly erodible or compactable (OIG 1999 pg. 17). The following section discusses soils in regard to erosion, slope stability, and compaction.

# Erosion

Two primary erosion processes occur in the watershed: fluvial erosion and hillslope erosion (Wash. State. Dept. of Natural Res. 1997). Fluvial erosion will be discussed in the Hydrology section. Hillside erosion is described below.

Soil creep is widespread and perceived to be the dominant hillslope erosion process in the watershed. Landslides, slumps, debris avalanches, and other mass erosion processes occur, but are infrequent[5]. It is presumed that for a time following hot, stand-replacement types of wildfires, surface erosion, a process not generally associated with forested mountainous terrain, likely occurred to an elevated degree. The same is inferred for debris slide frequency (South Deep Creek Watershed Analysis 1999).

The inherent sediment regime has been altered to some degree in the watershed by land use practices. Land use and human infrastructure, both past and present, such as roads and their use, logging, cattle grazing, mining, and the development of private residences, have affected the erosion processes in the watershed. Now surface erosion is a process that is much more prevalent across the watershed. Most of the surface erosion observed is from roads and other developments (i.e., homes, barns, log landings, etc.) located near streams (South Deep Creek Watershed Analysis 1999).

## *Surface Erosion Potential*

Erosion potential refers to the susceptibility of a soil surface to erode from bare slopes as a result of water action. The types of water erosion that can occur are sheet, rill, and gully erosion.

Erosion potential is strongly related to slope, and less strongly related to soil texture, infiltration rate, and coarse rock content. In general, silty soils on slopes greater than 60% generally exhibit severe erosion potential, while soils on slopes between 30 and 60% exhibit high erosion potential. Soils on terraces exhibit low[6] to moderate[7] surface erosion potential, while those on terrace escarpments exhibit high[8] to severe potential. Valley bottom soil types exhibit low to moderate erosion potential, depending on slope (South Deep Creek Watershed Analysis 1999).

Surveys of proposed treatment areas and past timber sale units were conducted for this analysis. None of the sampled areas contained areas of extensive surface erosion[9]. Current timber harvest contract requirements appear to keep equipment on the flatter slopes, leave effective vegetative ground cover, and provide drainage structures adequate to mitigate the impacts of erosion caused by logging equipment.

Erosion was observed on the driving surface of roads and on cut and fill slopes. Gully and rill erosion was observed associated with road surfaces, in the ditchlines, and below roads where water is concentrated. Of the 27 gullies/rills identified, 93% were located on glacial materials, while 7% were located on rockier materials. All gullies were associated with roads.

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[5] Most of the landslide activity in this area appears to be associated with roads and problems with road drainage.

6LOW MEANS THE POTENTIAL FOR SURFACE EROSION IS INSIGNIFICANT. IN GENERAL, LOW APPLIES TO VERY FLAT SLOPES, BOTTOMLANDS, AND DEPRESSIONS.

7 MEDIUM MEANS THE POTENTIAL FOR EROSION IS HIGH WHEN THE GROUND IS BARED AND DISTURBED, SUCH AS OCCURS ON MOST TRACTOR SKID TRAILS AND MAY OCCUR IN YARDING CORRIDORS. EROSION CAN BE REDUCED BY CAREFUL LOGGING, BY AVOIDING UNNECESSARY DISTURBANCE, AND BY THE USE OF STANDARD BEST MANAGEMENT PRACTICES.

8 HIGH MEANS THE POTENTIAL FOR SURFACE EROSION IS HIGH WHEN THE GROUND IS BARED. EXTENSIVE EROSION CAN BE EXPECTED TO OCCUR FREQUENTLY ON BARE SURFACES, SUCH AS TRACTOR SKID TRAILS. EROSION CAN BE REDUCED BY AVOIDING BARE SOIL AND BY THE STRICT APPLICATION OF BEST MANAGEMENT PRACTICES.

9 IN ORDER TO MEET THE CRITERIA AS A DETRIMENTAL SOIL CONDITION, AN AREA OF EROSION MUST BE VISUALLY EVIDENT (I.E., WASH, PEDESTALS), MUST BE MORE THAN 5 FEET WIDE, AND MUST ENCOMPASS AN AREA OF AT LEAST 100 FT.

### *Slope Stability (Landslide Hazard)*

Mass wasting refers to the dislodgment and downslope transport of soil and rock material under the direct application of gravitational body stresses. Mass wasting may be the result of two types of mass movements:

Surficial movements of relatively small deposits (e.g. debris slides, debris flows and sluice-outs); and

Deeper and/or more widely encompassing movements (e.g., soil creep, slumps, earthflows and landslides.)

Mass wasting potential strongly relates to slope and soil characteristics such as horizons that inhibit water movement and perched water tables. In general, soils in this area are stable and landslides are uncommon. Most of the analysis area exhibits a low to moderate potential for mass wasting. Areas exhibiting a high mass wasting potential exist on steep slopes on the southern side of Ione Hill and on steep valley sidewalls between Rogers and Clinton Creeks.

The South Deep Creek Watershed Analysis (1999) identified landslides in the 1945 aerial photos "spanning the lower reaches of Rocky Creek and on the lower slopes of the Polley Creek drainage." These slides appeared to be deep-seated rotational slumps and are found in an area of deep glacial deposits. None of these slides are currently active.

Fifteen 'recent' slides were identified through both aerial photo and field reconnaissance. All of the recent slides are small (less than ¼ acre in size), most are very small (a few cubic yards). Thirteen of the 15 are associated with roads. All of the slides are found in glacial deposits.

The most common slide encountered in this area is small slumps on road cut-slopes. The slumps typically occur in deep glacial material, and occur in conjunction with groundwater seeping from the cut-slope. The hillslopes are often gentle. Generally these small slumps do not impact water quality, and do not cause important impacts to the roads.

Debris slides were the other type of slide observed. Ten debris slides were observed; 8 of the 10 were started by roads. Most of the debris slides occurred in glacial material. In most cases, problems with road drainage funneled water onto fill slopes which failed. Of the 2 debris slides not located on roads, 1 debris slide is located in an old clearcut in the upper Miller Creek drainage (Smackout Unit 9), and the other is located in an untreated area in the Rocky Creek drainage.

## Compaction

Compaction potential refers to the compression of soil particles closer together, reducing the amount of pore space of the soil. The process of compaction increases soil density and can occur as a result of the movement of wheeled and tracked equipment, as well as other logging practices.

Compaction potential is related to soil texture and the amount of coarse rock fragments in the soil. In general, soils with a silty loam texture and few rock fragments, such as found in volcanic ash soils, have high compaction potential. Soils are most compactable when moist.

Detrimental compaction in the South Deep analysis area appears to occur on all soils with sufficient compactive effort. Most of the compaction observed occurred on places subject to multiple passes by heavy equipment, i.e. skid trails, old and current roads, and landings.

### *Wet and Seasonally Wet Soils*

Many of the wetland soils in this area are located in the Deep Creek valley. The following wet and seasonally wet soils are found on private lands, generally along Deep Creek.

- Bridgeson silt loam is found on private land along Deep Creek.
- Chamokane loam is found on private land along Deep Creek.

- Rathdrum silt loam is found in slight depressions on terraces. A small area of this soil is found on private land in the Blue Ridge area of Harrier Creek.

The following wet and seasonally wet soils are also found on National Forest System lands.

- Kegel loam is found on low floodplains along mountain streams. These areas occasionally flood in the spring.
- Bossburg is found in wetlands surrounding low gradient streams. These areas generally support wetland vegetation and are wet well into the summer.
- Narcisse silt loam is found on low floodplains along Rocky Creek and Deep Creek. These areas are generally wet in the spring and dry out in the summer.
- Borosaprists, ponded, are found along low gradient streams. These soils are located along Meadow Creek just below Big Meadow Lake. They are wet year-round.
- Histosols, ponded, are found in depressions often located in upland areas. These soils are typically wet year-round.

# Cumulative Effects of Past Activities

## *Effect of Homesteading and Fires in the Early Part of the 1900's*

South Deep was homesteaded during the early part of the 20th century. During that era logging and agricultural uses occurred throughout the analysis area. Large areas were cleared for cattle grazing and cultivated for crops (mostly hay), including areas that later became National Forest System lands. Land that was less suitable for agriculture and homesteading was returned to the Federal Government around 1930-1940 and became the Colville National Forest. However, many old clearings (commonly called "homestead meadows") persist today.

In 1926 and 1929, large stand-replacement wildfires burned through about two-thirds of the analysis area. Today most of the area is second-growth timber. It is difficult to estimate to what extent these fires impact the soil today. No doubt, erosion rates in the first few years following the fire were high. No doubt these fires volatilized plant nutrients, and other nutrients were lost due to leaching and erosion. Currently, the duff is 1-3 inches deep, consistent with the vegetation, moisture and temperature regime of the site. Small down woody material is abundant, though large wood is not common. Soil's ability to support root growth is good, and the volcanic ash layer (where present) is fluffy with no signs of heat damage apparent at this time. The vegetation appears to have recovered from the past fires, and the soils appear to have recovered as well.

It is uncertain how logging activities from 70 to 100 years ago continue to effect soils today. While old stumps are evident in many stands, the soils appear to be undisturbed in old logging units. The duff layer is generally the same depth as undisturbed soils and consistent with the vegetation, moisture, and temperature regimes on the site. Down-woody material is also normally abundant on these sites. Based on these observations, homestead era timber harvest appears to have had no long-term effect on soil productivity or function.

Many old roads continue as part of the present transportation system. Some old abandoned roads from the homestead era overgrown, but a road prism is still evident. These compacted road surfaces continue to be a detrimental soil condition. Also, created homestead meadows continue to be grazed by livestock and used for dispersed recreation.

## *Mining*

The analysis area has a history of hard-rock mining dating from the late 1800's. The primary soil impacts from mining are compaction and displacement; typically located on access roads, areas

cleared around adits, and areas cleared for buildings. Three of the 9 old mines in the planning area are located on National Forest System lands (Magma Mine, Lasota Mine, Rocky Creek Mine).

The Rocky Creek Mine is located near FR 7018200. The total area impacted is about 1 acre; about 15% of the area impacted has detrimental soil conditions.

The Lasota Mine in located on FR 7018300. The total area impacted is about 1 acre; about 15% of the area impacted has detrimental soil conditions.

The Magma Mine is located on FR 1728. The total area impacted is about 3 acres; about 20% of the area impacted has detrimental soil conditions.

In total, about 5 acres are impacted, and about 1 acre has detrimental soil conditions due to past mining.

Although the area is still open and available for mining activity, little activity has occurred within the past 20 years.

## *Effects of Timber Harvest Activities and Powerlines Constructed in the Latter Part of the 1900's*

The fires in the 1920's and 1930's left many areas with stands of small dense trees. Intensive timber management by the Forest Service began in the 1970's. Timber management included both commercial harvest and treatments to improve the condition in the densely-stocked, small diameter stands.

Some of the densely-stocked, small diameter stands were treated in the late 1960's and 1970's using 'dozer thinning'. Dozer thinning typically consisted of running a tractor over the standing vegetation – including the trees -- in strips that were usually 10-20 feet apart. Areas treated with dozer thinning include the headwaters of Rocky Creek, Blacktail Butte area between Polley Creek and Rabbit Creek, Aladdin Mountain, Kenny Creek, and upper Scott Creek. Dozer thinning appears to have occurred on about 25% of the National Forest System lands within the planning area[10]. The impacts of dozer thinning on soils are generally slight. The material (brush and trees) under the tractor appeared to have prevented extensive compaction. The resulting treatment areas typically had excellent cover, again from the brush and trees, preventing extensive erosion. Undoubtedly, the treatment left a large amount of smaller woody material on the ground, but the signs of this are not apparent today. Walk-through exam of some of these stands found Detrimental Soil Conditions ranging from 0% to 10%, and the most common Detrimental Soil Condition is compaction and displacement.

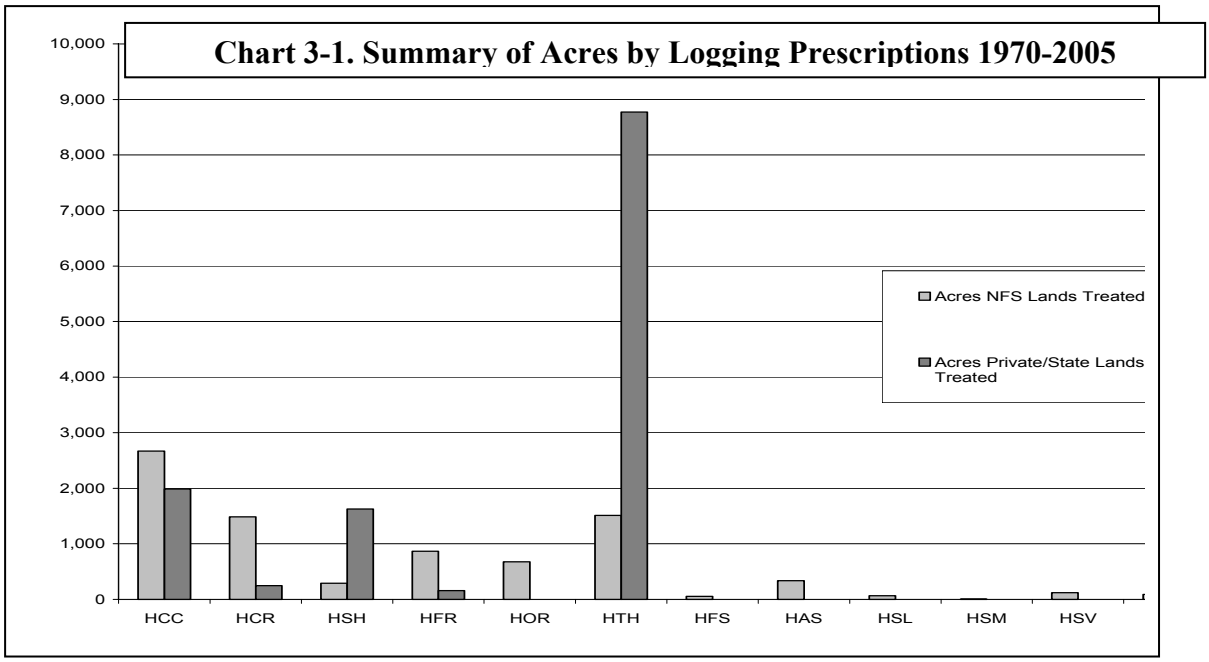
Commercial timber has been harvested on about 21,000 acres in the South Deep analysis area since World War II. Most of this harvesting was done with tractor yarding systems (92%), and the majority occurred on state and private lands. The following table displays information about past logging.

**Table 3-1. Summary of Past Logging in the South Deep Soil Analysis Area**

| | **Acres** |
|---|---|
| Total acres harvested.<br>41% of the total analysis area has had commercial timber harvest. | 20,949 |
| Harvested on private and state lands.<br>63% of the private, state and BLM lands have had commercial timber harvest. Most occurred on private lands. | 12,789 |
| Harvested on National Forest System lands.<br>27% of the National Forest System lands have had commercial timber harvest. | 8,160 |

[10] Rough estimate based on reviews of the 1972 aerial photos.

On National Forest System lands, logging prior to about 1970 tended to be partial cutting, often salvage, sanitation, final removal, and overstory removal. Most of this early cutting does not appear on the District's Activity Database; it is visible on the 1972 aerial photos. Most of this early logging was done with a tractor. Since the mid-1970's, logging on National Forest System lands was recorded in the District's Activity Database. The following chart shows the prescription types for cutting on National Forest System, private and state lands. National Forest System lands were typically treated with even-aged prescriptions, while private and State lands were more commonly treated with commercial thinning.




About 4,500 acres of National Forest System lands that had some logging prior to the mid-1970's were surveyed for existing Detrimental Soil Conditions. The only detrimental soil condition observed in these older logged areas is compaction and displacement on roads, skid roads, landings and some skid trails. The extent of detrimental soil conditions is variable depending on the amount of wood removed, the logging system, the time of year, and the skill of the operator. Cutting prior to the mid-1970's appears to have occurred on perhaps 30% of the planning area[11]. Detrimental soil conditions ranges from 0-17% in these area, with an average of 4%.

Starting in the mid-1970's harvest prescriptions changed to emphasize even-aged management, logging equipment got bigger, and practices such as machine piling of slash became more prevalent. Thirteen Forest Service timber sale units, logged between 1983 and 1992, were surveyed for Detrimental Soil Conditions in 2000 and 2001[12]. A total of 680 acres of recently harvested units were sampled within the analysis area. This represents about an 8% sample of all Forest Service units harvested in the last 30 years. The following table displays the data. The duff is typically thinner in these stands than in older, adjacent stands. Down woody material is less common and generally small in size. The changes in duff depth and forest floor composition appear to reflect the characteristics of younger even-aged stands. These plantations are stocked with conifers and brush, and typically have 100% effective soil cover. No signs of continuing, wide-spread erosion were observed. The most common detrimental soil conditions found are compaction and displacement on roads, skid trails, and landings.

[11] Rough estimate based on review of 1972 aerial photos.

[12] The Forest Plan was adopted in 1988. Limits on detrimental soil conditions were 'recommendations' prior to adoption of the Forest Plan.

These findings are consistent with the conclusions reached in Cumulative Effects of Forest Practices in Oregon, literature and synthesis (Beschta et al. 1998), which found compaction and displacement to be the effects of timber management most likely to accumulative through time.

**Table 3.2 Detrimental Soil Condition Monitoring in Past Harvest Areas**

| Timber Sale and Unit | Detrimental Soil Conditions | Primary Type of Detrimental Soil Conditions | Unit Harvest Information | | |
|---|---|---|---|---|---|
| Aladdin #14 | 0.5% | Displacement | 1985 | Clearcut | S |
| Ione Hill #4/7 | 1.5% | Visually recognizable compaction on roads, landings and skid trails was the primary detrimental soil condition. Displacement was the second most common, again associated with roads, landings and skid trails. Detrimental soil conditions due to burning, erosion and puddling were not encountered. | 1985 | Final Removal /Reserve Seed Tree | T |
| Clinton Creek #1 | 3.6% | | 1986 | Clearcut | T |
| Paradise Valley #2 | 24.8% | | 1985 | Clearcut | T |
| Ione Hill #4 | 2.5% | | 1985 | Final Removal | T |
| Byers Creek #5 | 16.5% | | 1983 | Clearcut | T |
| Paradise Valley #5 | 15.7% | | 1986 | Clearcut | T |
| Paradise #5 | 3.6% | | 1986 | Sanitation Harvest | T |
| Ione Hill #6 | 1.5% | | 1985 | Reserve Seed Tree | T |
| Aladdin #7 | 9.8% | | 1988 | Clearcut | T |
| Polley Cabin #12 | 8.4% | | 1991 | Clearcut | T |
| Aladdin #18 | 21.3% | | 1992 | Clearcut | T |
| Polley Cabin #26 | 7.8% | | 1990 | Salvage Cut | T |

One powerline crosses National Forest System lands in the northeast section of the planning area. This powerline is about 3.75 miles long, and about 100 feet wide. Where slopes were conducive, it appears that the clearing was performed with a tractor and the material was piled with a tractor. Detrimental soil conditions within this powerline right of way appear to be about 25%-40%, and they consist of compaction and displacement.

## *Livestock Grazing*

Livestock grazing causes some compaction in heavily used trails, and in areas where livestock congregate. On wet soils, livestock can also be responsible for puddling and trampling.

The project area contains all or portions of three livestock grazing allotments. Rocky Creek does not contain an active grazing allotment. Livestock tend to congregate where both water and forage is available, often gathering in meadows and along stream courses. Moderate levels[13] of livestock use occur in meadows and in some riparian areas in South Deep. The cattle fence around the campground and wetlands below Big Meadow Lake has not been maintained during the last few years, and as a result livestock are beginning to impact soil and water resources in

[13] A moderate level – livestock/wildlife trails were observed with enough cow pies associated with the trails to assume they were used by livestock. There was no estimate of livestock browse utilization.

this area. Livestock also graze on the cut and fill slopes along most of the roads. The rest of the planning area receives light use.

Cattle and wildlife impacts[14] were found in five of the past harvest units sampled (Aladdin #18, Polley #26, Paradise #5, Clinton #1, and Polley #12). The average detrimental impact in these five units from cattle and wildlife was 2.3% (compaction and displacement). Many cattle/wildlife trails are also located along roads and skid trails. It is difficult to determine the amount contributed by each; however cattle are estimated to cause detrimental impacts between 1-2% on South Deep soils. This conclusion is consistent with field observations in other harvest units on the district.

## *Recreation*

The impacts of recreation on soil and vegetation are generally considered "severe" but spatially limited and of limited significance at the landscape scale (USDA Forest Service, 1988; Marion and Cole, 1996; Cole, 1994; Cole 1996). This planning area includes one developed campground (Big Meadow Lake) and about 12 dispersed recreation sites.

The campground and associated trails occupy about 30 acres within the planning area. The primary detrimental soil condition within the campground is compaction of the roads, trails and campsites. Secondary impacts include a reduction of the organic and forest floor material by trampling, and removal of large woody material for firewood. The percent of the campground in a detrimental condition was not calculated because the soil quality standards do not apply to developed recreation sites.

The Big Meadow Lake area also has about 3.8 miles of hiking trails (Trails 120 and 125). These are foot trails, about 2-3 feet wide. The primary detrimental soil condition associated with these trails is compaction.

At dispersed campsites, trampling compacts the soil and abrades the organic horizon causing a decrease in the organic horizon (Cole 1996). This planning area contains about 12 dispersed recreation campsites, including two trailheads (source: GIS gfa cover). Several sites are clustered in the Big Meadow Lake area. Most of the sites are located in or on the edge of homestead meadows. Big Meadow Lake Cabin is probably the most heavily used dispersed recreation site in the planning area. The site, an old homestead, includes some parking and a cabin in a 6-acre homestead meadow.

## *Fire Exclusion*

The effects of fire exclusion on soil have not been studied extensively. According to Smith and Fischer (1997) fire exclusion has allowed fuels to accumulate on the forest floor, causing the duff to be thicker and the amount of down wood is probably greater. On exposed south and west facing slopes the plant association is Douglas-fir-ninebark, a plant association that generally has a short fire-return interval. On these sites, the duff is generally about 1-2 inches thick, which may be thicker than would occur under a natural fire regime. On sites with longer fire-return intervals, such as the western hemlock plant associations found on the flatter sites, in protected locations, and on north aspects, the duff is also about 1-3 inches thick which may be appropriate for these sites.

Fire exclusion has probably allowed rocky sites to become forested where they may have supported brush under a short fire-return interval fire regime.

Without fire exclusion, these stands probably did not have the homogeneity which we see today. Areas of thick duff and heavy accumulations of down wood would have been interspersed with areas that had been burned or underburned. Harvey (1999) suggests that fire suppression has changed the location of nutrient pools moving nutrients from the soil and high canopy to the forest

[14] It is impossible to distinguish livestock trails from wildlife trails. No doubt, they use the same trails. If a large number of 'cow pies' were observed, the trails were considered 'livestock' trails.

floor and low canopy trees. This shift in nutrient pool and organic matter load could make sites, especially sites with a short fire return interval, more vulnerable to nutrient losses from fire. These changes have probably affected soil microbiology, soil chemistry and nutrient cycling.

### *Roads and Rock Pits*

Roads are a long-term detrimental soil condition. Areas converted to roads and rock pits are generally considered "removed from the productive landbase". The planning area has two rock pits on National Forest System lands. The Byers Creek pit is about 3 acres and the Thomas Mountain Quarry is about 11 acres.

The South Deep Analysis area has about 220 miles of road. The roads vary from single-lane dirt tracks to one two-lane paved road (Aladdin Road). Width varies from about 20 feet to more than 60 feet. For this analysis, the disturbed road prism (from top of cutslope to bottom of fill slope) is assumed to average about 50 feet or about 6 acres per mile of road.

### *Summary*

At a landscape sale, the existing detrimental soil conditions are low. Most of the detrimental soil conditions that have occurred are limited in extent, intense, but widely scattered and do not occupy a large percentage of the planning area.

- Timber harvest between the mid-1970's and today occupy about 41% of the planning area, but only about 27% of the National Forest System lands within the planning area. Detrimental soil conditions in these areas are variable; ranging from less than 10% to about 25% of the harvest unit.
- Timber harvest prior to the mid-1970's occupied about 30% of the National Forest System lands within the analysis area. Detrimental soil conditions are generally about 4% in these areas.
- Roads and rock pits occupy about 3% of the planning area. These roads and pits are a long-term detrimental soil condition.
- Powerline right-of-way occupies about 0.4% of the planning area. Detrimental soil conditions are about 25% within the right of way (including roads).
- Dispersed campsites, campground and trails, occupy about 0.09% of the planning area. Detrimental soil conditions in these areas are compaction and displacement.
- Past fires and homesteading have impacted the soil, but detrimental conditions are not apparent today.

# 3.1.2 Hydrology: Affected Environment

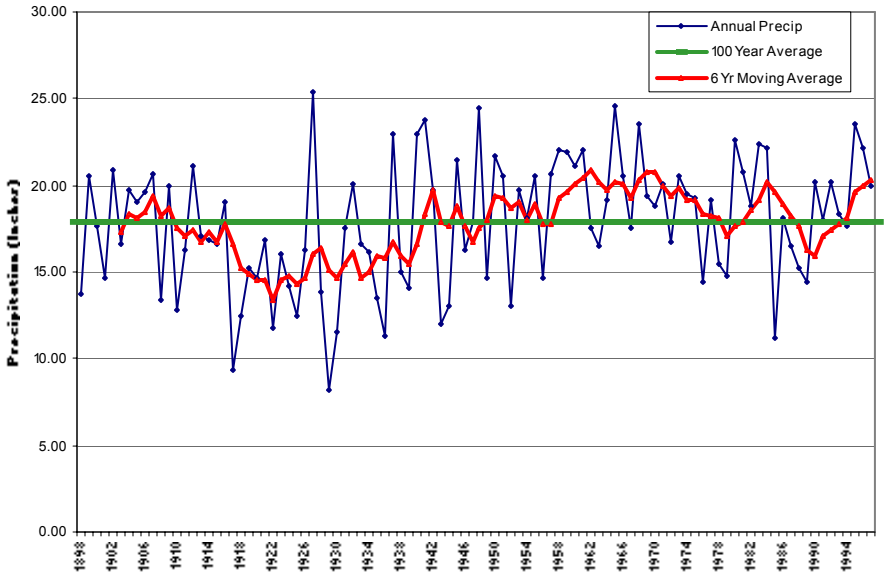
## Climate

The climate of the analysis area is a combination of maritime and continental air masses that influence precipitation and temperature patterns. In the summer the maritime influence from the Pacific Ocean is dominant, while in the winter the arctic air mass from Canada maintains the snowpack. There are no known continuous records of climatic data within the South Deep watershed. The closest location of record is at Colville, Washington, approximately 15 miles southwest of the watershed at an elevation of 1,877 feet. Actual temperature and precipitation values for higher elevations in the South Deep watershed are likely measurably different than those collected at Colville. Mean values for the Interior Columbia Basin Ecosystem Assessment, Volume I, indicate that mean annual precipitation in the watershed is about 34 inches, with a summer mean of 6 inches and a winter mean of 10 inches. The average annual precipitation

ranges from approximately 20 inches at the southwestern corner of the analysis area, to approximately 45 inches in the vicinity of Seldom Seen Mountain between the Rocky Creek and Meadow Creek drainages.

**Chart 3-2**

**Six Year Moving Precipitation Average at Colville, WA (1898-1997)**




Continuous precipitation records at Colville between 1898 and 1997 show some interesting trends during this time period (Chart 3-2). The 1920s and 1930s showed a significant drought period when annual precipitation averages fell below the 100-year annual average of 17.84 inches. This below average period was followed by almost 40 years of above average precipitation. The 6-year moving average on the chart above displays these trends by smoothing the precipitation fluctuations that occur on an annual basis. The first year/point plotted on the 6-year moving line of Chart 3-2 is 1903 because of the need to average the first six years of data before a point can be registered on the graph.

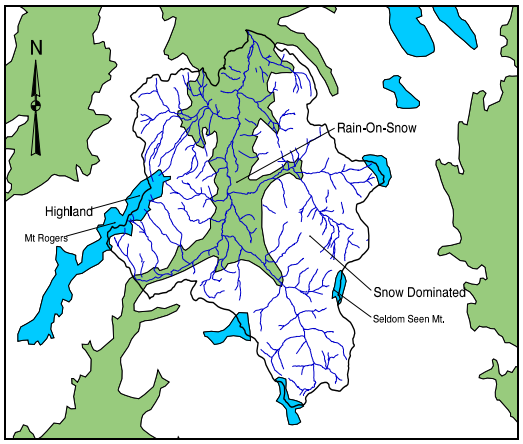



**Figure 3-1. General Snow Accumulation Zones**

The map in Figure 3.1 represents general snow accumulation zones and is based on average amounts of snow on the ground in early January relative to the amount that could reasonably be

melted during a model storm event. Five snow zones (based on climate, elevation, latitude and vegetation) are defined for the state of Washington -- highland, snow dominated, peak rain-on-snow, rain dominated, and lowland. Three of these zones are located within the South Deep analysis area (Table 3.3).

**Table 3.3 Precipitation Zones by Elevation Range**

| Precipitation Zone | Elevation Range |
|---|---|
| Rain on Snow | 1,800 to 3,200 feet |
| Snow Dominated | 3,200 to 4,800 feet |
| Highland | above 4,800 feet |

Elevation, wind speed and air temperature are significant factors in influencing the amount of snowpack that will melt over a given period of time. In most cases, increasing elevation will increase wind speed and reduce air temperatures. The current vegetative condition of a subbasin will also affect snowpack melt rates. The forest canopy acts as an insulation blanket, slowing wind velocities and reducing air temperatures above the snowpack.

There are 13,022 acres (26%) of the analysis area that are considered at-risk of a rain-on-snow event. The remainder of the area is located in the snow-dominated and highland zones. This rain-on-snow area is located at the lower elevations along the main stem of the South Fork of Deep Creek and the lower elevation reaches of Rocky Creek, Meadow Creek, and Harrier Creek.

“The hydrology of the Northern Glaciated Mountains Ecological Reporting Unit in which South Deep Creek is located, is best characterized as snow-pack dominated. More than half the annual runoff is estimated to be snowmelt influenced, about a third by snow and rain, and about 10% by groundwater. Peak discharge generally occurs from May through June. Periodic rain-on-snow events, however, can cause elevated streamflow during winter months. Generally, base flow in the summer is maintained by groundwater and is relatively unaffected by precipitation, although precipitation in the form of infrequent showers or occasional storms may cause minor streamflow increases.” (South Deep Watershed Analysis 1999) Mid-winter rain-on-snow events are rare, but can cause runoff damage from peak flows. Late spring, rain-on-snow events and/or Chinook wind events are more common, but they are usually confined to the higher elevations and resulting peak flows are localized and usually not excessive (Quiqley 1997).

# Water Quality

The State of Washington is required under Section 303(d) of the federal Clean Water Act to periodically assess and prepare a list of waters in which beneficial uses are impaired due to water quality problems.

The current state water quality standards group water bodies into five categories:

Category 1: Meets tested standards

Category 2: Waters of Concern

Category 3: No Data

Category 4: Polluted waters that do not require a total maximum daily load

Category 5: Polluted waters that require a total maximum daily load

Meadow Creek is currently listed as a Category 5 stream for pH according to the Washington State 2002/04 303(d) list of impaired surface waters. Meadow Creek was also on the Washington State 303(d) list in 1996 and 1998 for fecal coliform bacteria; however it has been reclassified as a Category 2 stream on the latest 2002/04 list. The mainstem of the South Fork of Deep Creek is currently listed as a Category 5 stream for pH and temperature. This listed segment is located

outside of the forest boundary downstream (north) of the confluence of the mainstem with Meadow Creek. Rocky Creek is listed as a Category 2, Water of Concern for fecal coliform, dissolved oxygen, and pH. It will remain as a Category 2 until further monitoring verifies that the stream continues to meet state water quality criteria. No other waters within the South Deep watershed are on the current state list of impaired waters.

Approximately 250 miles of federal, county, and private roads exist in the South Deep analysis area[15]. Road densities in the project area average 3.37 miles per square mile (mi/mi) Riparian road densities average 0.46 mi/mi. Both the Meadow Creek and Rocky Creek sub watersheds have riparian road densities above the analysis area average because county roads are located along the creeks especially in the lower portions of these drainages. Stream crossing frequencies range between 0.9 and 1.9 crossings/mile of stream. Meadow Creek, with the fewest miles of stream (in the project area), has the highest crossing frequency.

Most stream banks throughout the analysis area are stable and well vegetated with a variety of riparian species. The root depth and density of these plants provides surface bank protection during normal peak flows in these watersheds, and large woody in-channel debris stores sediment, and reduces flow velocities. Some natural riparian stream function has been affected in areas of previous riparian harvest. In these areas bank stability has been affected by the removal of deep-rooted vegetation. Riparian timber harvest has also reduced the potential for the recruitment of future sources of large woody debris and may have influenced stream temperatures. The area's greatest riparian impact has occurred where roads encroach upon floodplains. The most significant areas are along the lower reaches of Rocky Creek and Meadow Creek where county roads constrict the stream channels resulting in increased stream velocities and bank erosion. Surface erosion from the road template (cutslope, fillslope, and travelway) is also reaching the streams in some areas adding to the sediment load carried downstream.

# Stream Flow Regimes

Water yield is a generic descriptor related to the changes in the rate, frequency, and timing of runoff that a watershed exhibits in response to hydro-climatic events (rainfall and snowmelt). The quantitative change in yield and timing of flow is a function of many parameters including vegetative species; stand densities and patterns; soil depth and texture; precipitation type, duration, intensity, depth and seasonal distribution; geology and other factors. In most cases, streamflows increase as stand density (and evaporation) decline. Forest canopy interception and transpiration are the primary vegetative factors controlling water yields. Modification of the forest canopy results in a direct response of interception and transpiration.

Fire prevention and suppression during the last century has resulted in the growth of dense forest stands throughout the analysis area. Timber harvesting has reduced the density of larger trees within the forest, particularly on gentler slopes, and has created occasional large openings through regeneration harvest. Water yields may have declined since the beginning of the 20$^{th}$ century due to the existing denser stand conditions over much of the analysis area. In these stands interception of rain and snow in the forest canopy is higher than normal, leading to evaporative loss of water. In addition, transpiration rates are higher than reference conditions due to increased stand densities (Brogan, personal communication).

While the analysis area is normally dominated by an arctic air mass during the winter, maritime influences from the Pacific Coast in the form of warm, moist fronts may occasionally invade the area. The intervening mountains of northern Washington usually reduce the influence of these air masses; however those that manage to invade can have a profound effect on the hydrology of

[15] The terms analysis area and project area refer to two different geographical areas within the South Deep watershed. The analysis area is synonymous with the watershed boundaries of the South Fork of Deep Creek. The project area refers to that portion of the analysis area within the administrative boundary of the Three Rivers Ranger District. Use of the project area essentially eliminates the Harrier Creek sub watershed, and focuses the analysis on Meadow Creek, Rocky Creek, and the 1$^{st}$ and 2$^{nd}$ order streams referred to as the "South Deep Tribs".

the area. Such events are relatively uncommon, but when they do occur they represent the highest peak flows in the area.

The snowpack is most susceptible to rain-on-snow events if it is located in the 1,800- to 3,200-foot elevation range. Below 1,800 feet the snow pack is often transitional during the winter (it may accumulate and abate several times during the season) and may not be a substantial contributor to the overall basin runoff. In many years the snow pack above 3,200 feet is usually "cold" with a large thermal deficit[16] in the midwinter months.

Management or natural vegetative modifications that minimize the boundary layer of air next to the surface can affect rain-on-snow response. Openings in timber stands permit a relatively smooth flow of air to blow over the snowpack and retard the formation of boundary layers. An effectively closed tree canopy reduces wind velocity, allowing a deep boundary layer to form. Trees in a more open stand that extend above the snow surface can create turbulence that decreases the boundary layer over the open condition. Brush is ineffective since it rarely extends the necessary height above the snow pack surface of the area. Snags may create some turbulence, but their sparse character and lack of limbs and foliage greatly reduces their effectiveness.

Rain-on-snow is a natural process under which the streams of the basin developed. However, within the South Deep analysis area, the dominant channel forming events are associated with spring runoff. The inherent sensitivity of each watershed to rain-on-snow events can be estimated by calculating the sensitive snowpack. This parameter does not change with activities. The portion of the watershed that supports this sensitive snowpack is a parameter that is partially representative of the overall sensitivity of the watershed itself. As a point of reference, watersheds with a small proportion of sensitive snowpack (less than 30%) do not appear to be very responsive to rain-on-snow events at the watershed scale. Watersheds with a large proportion (more than 70%) of sensitive snowpacks are often highly volatile and are further very sensitive to other disturbance regimes in terms of runoff from the stream system.

The South Deep watershed has approximately 26% of the analysis area in sensitive snowpack elevations. Most of this area is located at lower elevations outside the forest boundary. Large floods that cause serious property damage and other problems normally occur simply when an extended period of very heavy rains add too much water for soils and streams to absorb, regardless of land use (Adams, et al, 1994). The flood during the spring of 1996 in the Rocky Creek drainage is an example of such an event. The roads that impinge upon the floodplain and constrict the stream at lower elevations intensified the effects of this flood.

Average annual water yields may actually decrease as fully stocked stands that were harvested are replaced by dense, second-growth stands and a general reduction of timber harvest levels (Berndt, et al. 1970). Untreated stands within the South Deep Analysis Area currently contain high stocking levels as a result of wildfires in the early part of the 20$^{th}$ century. Recent regeneration harvest units may be in a similar condition because of planting and subsequent ingrowth of natural regeneration. Some of these stands probably have higher evapotranspiration potentials than historic (reference) conditions (Brogan, personal communication). As a result current baseflows may be lower than historic norms.

The equivalent clearcut area is used to express the percentage of created hydrologic openings in a watershed and account for vegetative recovery occurring since the initial disturbance. The equivalent clearcut area model calculates the area of a watershed in a 'clearcut' condition at a specific point in time. Past vegetation manipulation treatments and natural disturbance events that have the potential to affect the water yield of a watershed are converted to equivalent clearcut area, added to alternative proposed treatments, and expressed as a percent of the total watershed area. The result can be compared to other alternative treatments and to the threshold of concern indicated in the Land and Resource Management Plan, Colville National Forest, Final

[16] It would require a large, prolonged storm such as a Chinook wind or rain-on-snow event to warm the snowpack to overcome this thermal deficit and result in high melting and runoff.

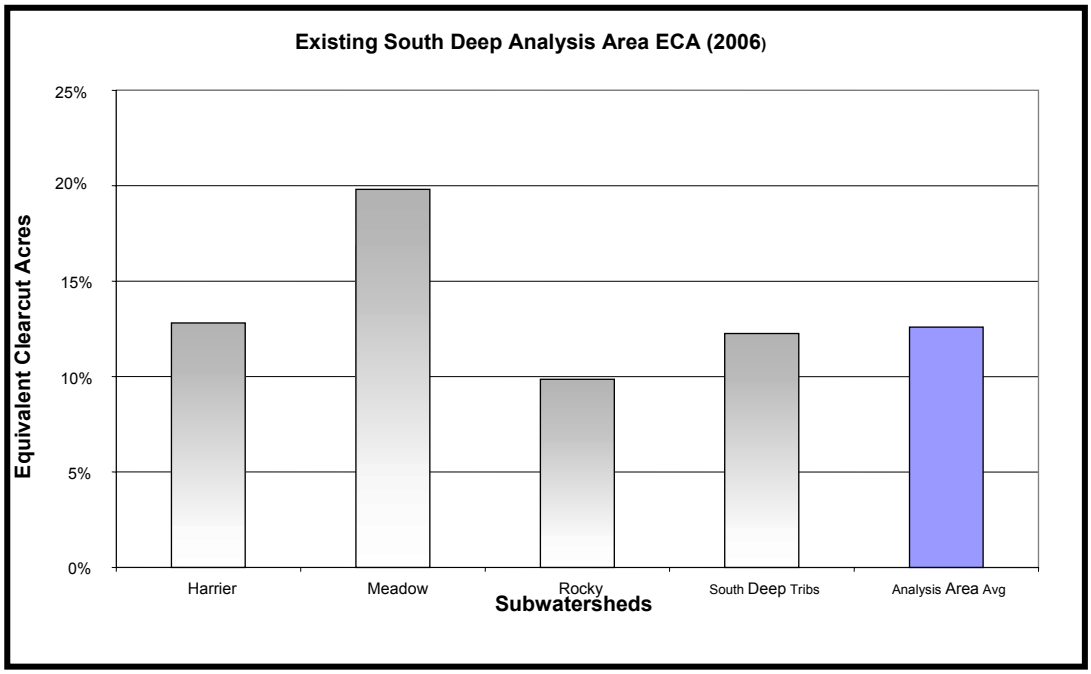
Environmental Impact Statement. The concept is adapted from “A Water Yield and Channel Stability Analysis Procedure: by Cliff Benoit and Dr. Alan Galbraith (1974). The equivalent clearcut area calculation can be used as an index of potential water yield changes due to management activities. If the equivalent clearcut area values exceed the established Forest threshold of concern, additional professional analysis of the potential for significant channel response or water quality changes is warranted (Wasson 1992).

The equivalent clearcut area model does not quantify the amount of increase in yield, peak flow, soil moisture or the amount of damage that can result. Rather it is used to indicate whether or not a basin is in a recovered hydrologic state. This model is best used to compare individual alternatives to one another and to the current condition. It can also be used to predict relative recovered states projected out into the future. The 25% threshold of concern for created openings in the Forest Plan is intended to be used as a relative indicator of a stable watershed (Wasson et al. 1992).

The equivalent clearcut area analysis for the existing condition (Figure 3.3) consists of adding equivalent clearcut areas of roads, harvest units, and wildfires that have occurred over the last thirty years. Equivalent clearcut areas are based on the number of acres treated, the percent of vegetation removed, and the year of treatment. As timber is removed and/or roads constructed, the amount of water yield (stream discharge) may increase due to changes in interception, and evapotranspiration. These changes may cause peak flows that could potentially result in channel damage if the harvested areas of a 3rd order (or larger) watershed exceeds 25% in a created open condition (Wasson 1992). It is expected that less than 25% dispersion of created openings within a watershed will not cause significant adverse cumulative effects and will meet water quality goals for the forest (USDA 1988). As the vegetation in these areas becomes reestablished, the watershed begins to recover hydrologically. Recovery in the equivalent clearcut area model is considered complete when a fully stocked stand of new trees reaches a height of 35 feet (assumed to occur 30 years after treatment). The recovery curve used by the Colville National Forest has been modified to reflect tree growth as modeled in the Forest Plan.

Meadow Creek (19.8%) is the only sub watershed within the project area approaching the equivalent clearcut area threshold established in the Colville National Forest Land and Resource Management Plan.

**Chart 3-3. South Deep Existing Equivalent Clearcut Areas by Subwatershed**



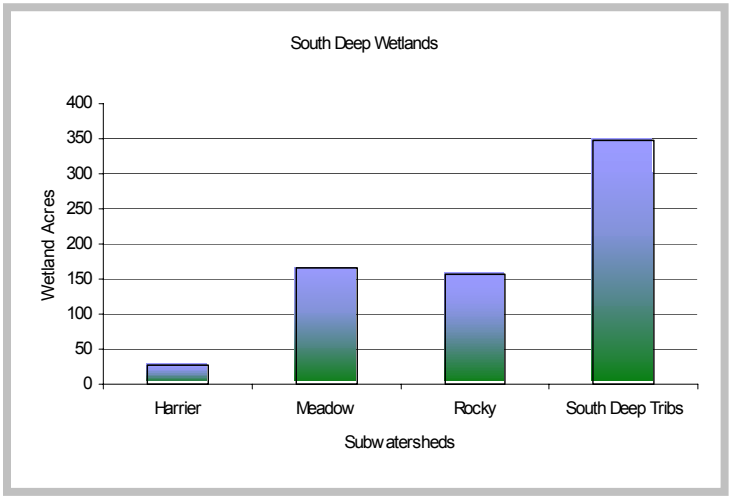




**Chart 3-4. South Deep Wetlands**

# Floodplains, Wetlands, and Groundwater

Primary wetlands found in the analysis area are riverine and palustrine (GIS National Wetlands Inventory). Riverine wetlands are located along main stream channels and glacial outwash floodplains. They are perennial, permanently flooded, and dominated by trees, shrubs, and persistent emergents. Palustrine wetlands are seasonally and intermittently flooded, scrub/shrub and forested wetlands that follow streams (including intermittent channels) to the head of the watershed. Many small seeps and springs that could not be quantified would most likely be delineated as palustrine.

Chart 3-4 shows the acreage of wetlands, by subwatershed, in the analysis area. Wetlands cover a small area in terms of the overall watershed. However, they play an important role in moderating peak flows and sustaining baseflows, especially during periods of drought. With the exception of Harrier Creek, wetlands cover between 1% and 2% of the analysis area. Many of these are located along the mainstem of the South Fork, the low gradient reaches of Rocky Creek, and the stream reaches below Big Meadow Lake.

Most of the headwater streams within the watershed are steep, narrow steams flowing through incised valleys and therefore have very narrow or non-existent floodplains. Very little groundwater information exists in the watershed. Small amounts of groundwater are currently being intercepted along road cutbanks and routed through ditch-lines to become surface flow in streams. Groundwater use in the planning area is primarily for domestic purposes (residential wells and livestock).

Floodplain function and the quality of the riparian vegetation have been maintained over most of the watershed. The basin is in good shape except at localized sites where human influences have altered both form and function of riparian and flood plain areas. Chart 3-5 shows the percentage of each subwatershed that is affected by human activities in riparian areas. Vegetation in dispersed and developed recreation areas has either been altered or trampled, and soils compacted. The impacts associated with the concentration of people in riparian zones include: trampled vegetation; slight increases in runoff, erosion; sediment delivery; and damage to the streambanks. Riparian logging has occurred on 2.8% of the analysis area (1,403 acres).These harvest treatments include older clearcut and partial cut units within zones of riparian influence. Logging practices in riparian areas and stream bottoms have frequently resulted in extensive and long-term loss of large woody debris, channelization and changes of alignment, loss of structural components, extensive compaction of soils, and other hydraulic modifications.

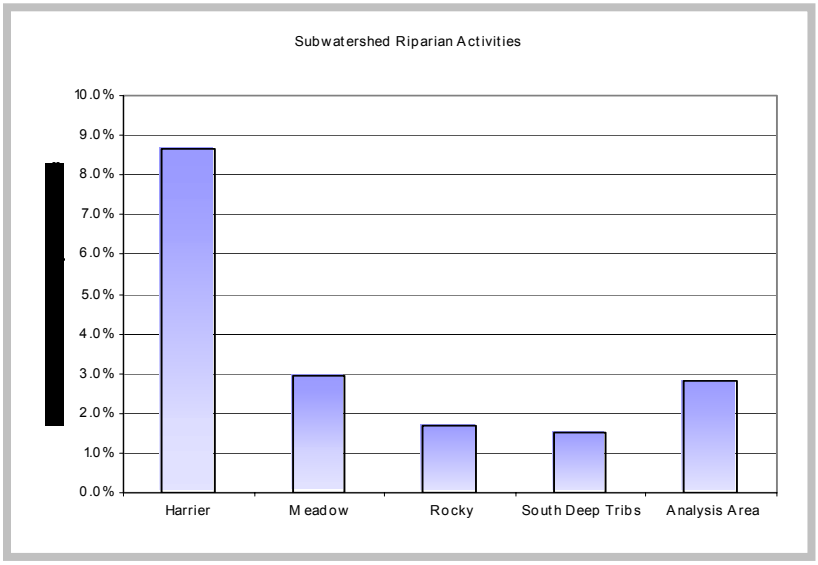



**Chart 3.5 Subwatershed Riparian Activities**

Fire suppression is a human activity that has resulted in the additional buildup of fuels in the riparian/wetlands/floodplains as well as upland areas. Greater recreation use in these riparian zones will increase pressure on these areas and degrade water quality, trample vegetation, compact soils, and increase the risk of fire.

The riparian effects of cattle are similar to those caused by human activity. Compaction of soil by grazing animals along with a reduction in ground cover may cause increased runoff and less infiltration into the soil. Livestock spend more time in riparian areas than in upland areas; consequently, the riparian areas are more intensively grazed. Use of riparian areas by cattle may also result in trampling of vegetation and destabilizing banks. Besides the direct impact on streams and lakes from trampling, there are secondary effects as well. Increased turbidity from erosion of the banks reduces primary productivity in the stream. Destabilized banks may also cause the channel to become wider and shallower. Once this happens the stream may continue to meander within the banks and increase bank erosion. This causes an increase in the sediment supply and decreases the stream's ability to move all of the sediment in the channel. Most of the effects of cattle are limited to road/stream crossings and low gradient channels such as the outflow below Big

Meadow Lake. The cattle fence around the campground and wetlands below Big Meadow Lake has until recently been maintained by the Forest Service. It has not been maintained during the last few years due to budget constraints and cattle are beginning to impact soil and water resources.

Roads and other facilities in valley bottoms inevitably occupy areas where the stream channel, its floodplain, and low terraces are normally located. This encroachment creates a constriction of the normal stream environment, resulting in deeper flows that lead to flooding and increased velocities which in turn may result in accelerated bed scour and bank erosion. That erosion is the source of tremendous magnitudes of sediment and can cause abnormal and prolonged channel adjustments that may even trigger new adjustments downstream.

# 3.1.3 Fire, Fuels, and Air Quality: Affected Environment

## Fuels, Role of Fire, and Fire Management

The following section discusses fire, fuels and fire management in terms of the respective biophysical environments. Plant associations of each biophysical environment are described in detail in Section 3.2.1, "Forests: Affected Environment".

### *Cool Mesic Western Red-Cedar-Hemlock/Forb Shrub Hemlock/Tall Shrub Biophysical Environments*

***Fuels***—Due to their high productivity, the stands found in cool mesic western red-cedar-hemlock/forb shrub hemlock/tall shrub biophysical environments often carry heavy fuel loading. Many stands have up to 50 tons/acre, much of it in the 3 feet+ category, and much of that rotten. In addition, there is usually a large component of twigs and small branchwood. These fuels are often the results of accumulated deadfall and natural thinning. Duff can be relatively deep and contains a high amount of rotting wood. Although fuel loading can be quite high in these stands, fire hazard is usually low, due to the high humidity in the understory throughout much of the summer months. In addition, green shrubs and other understory vegetation help act as a "heat sink" in both young and older, "parklike" stands. Thus, old-growth stands are often resistant to low-intensity fire, because the crowns of the larger trees can often survive torching of ladder fuels[17]. However, during drought periods, when surface fuels[18] dry out, fires may smolder for long periods of time, causing more severe fire effects. Once live fuel moisture decreases, conditions leading to stand-replacing fires will increase. Stand-replacing fires do not usually consume all duff, and can actually increase the amount of dead and downed fuels, as snags and other dead wood fall over in the years following the burn. After a stand is opened to sunlight by fire or some other disturbance, it will dry more quickly, and thus may be more susceptible to re-burn and extreme fire behavior.

***Role of fire***—Almost every stand visited within the watershed in this biophysical environment shows some evidence of fire, exhibited either by fire scarring on trees, or by charcoal in the soil, or by burned remnants of snags. However, fire scars on individual trees are not an indicator of fire regime, as individual trees tolerate fire differently. Because fire intensity varies with slope, aspect, vegetation, and elevation, a mosaic occurs after large fires, ranging from complete stand replacement, partially killed overstory with more seral species surviving, underburning with little

17 Overstocking of small trees and brush creates a ladder of fuel from the ground into the treetops by which fire can "climb" into the crowns of overstory trees.

18 Surface fuels are downed woody debris (logs, branches, needles) tend to accumulate over time without mechanical treatment or the natural occurrence of fire, creating the fuel conditions that cause severe fires that cause mortality to overstory trees and are hard to control.

overstory mortality or no burning at all. Due to variable fire intensities, patch shape can be very irregular, consisting of many islands and fingers of remnant structural characteristics and distinct edges between mosaics can persist for several decades. The more southerly aspects of South Deep at lower elevations generally exhibited lower intensities, while the riparian environments probably did not underburn.

***Fire management considerations***—Fire suppression has not substantially altered the stand-replacement fire regime in most of this biophysical environment, with the possible exception of stands dominated by seral lodgepole pine. Continued exclusion of fire has very serious potential consequences. Historic fires were essential recyclers of carbon and nitrogen stores and prevented many forest diseases from reaching epidemic proportions. Even though severe fire can decrease site productivity, it may not be as detrimental to long-term forest health as continued fire exclusion (Harvey et al. 1999). Management ignitions can be used in this biophysical environment to reduce fuel loads and increase variation in stand structure. Management ignited fires may decrease the likelihood of prescribed natural fires turning into unacceptable wildfires.

## *Cool Mesic Douglas-fir/Forb-Shrub and Cool Mesic Douglas-fir Grand Fir/Forb-Shrub*

***Fuels***—Fuels are variable in cool mesic Douglas-fir/forb-shrub and cool mesic Douglas-fir grand fir/forb-shrub biophysical environments, but can range as high as 40+ tons/acre. Potential fire behavior is dependent upon the structure of the understory, i.e., the presence or absence of ladder fuels, and downed wood. In addition, deep duff can contribute to severe fires. The shrub layer can either inhibit or contribute to potential fire behavior, depending on weather and live fuel moisture conditions at the time of the burn.

***Role of fire***—Fire's role in this biophysical environment, along with cycles of insect and disease, was to control forest composition and density. Stand replacing fires at intervals of less than 150 years favored lodgepole pine. If intervals were longer, Douglas-fir, western larch, ponderosa pine, and grand fir prevailed, with dominance determined by fire severity, size of openings, understory species and the frequency of subsequent underburns. Ponderosa pine regeneration was unpredictable, depending on heavy cone crops and low levels of competition from herbs and shrubs, but mature ponderosa prevailed on sites frequented by underburns. Douglas-fir established well where substantial duff remained, perhaps under the shelter of trees or shrubs; when mature, it could survive underburning.

Decades of fire suppression have caused stands that were once open and dominated by seral species to developed understories dominated by shade-tolerant species. Fuel loading and ladder fuels have also increased in these areas, and stand structure and composition has become more uniform over a landscape that was once characterized by mosaics due to fires of non-uniform severity. Older, homogenous stands often experience an increase in insect and disease mortality. Subsequently, larger areas may currently be more vulnerable to stand-replacing fire than they were in the past.

***Fire Management Considerations***—In areas where fire suppression has led to an increase in potential for severe fires, multiple low-severity burns conducted with high fuel moisture conditions could be used to reduce fuel loads and to increase variation in stand structure. However, underburning increases the likelihood of stem and root disease in grand fir and should only be applied in ponderosa pine, western larch, and Douglas-fir stands.

## *Very Moist Western Red Cedar/Western Hemlock Valley Bottoms*

***Fuels***—Woody fuels may be light or heavy, depending on site history, stand structure, and moisture conditions in very moist western red cedar/western hemlock valley bottoms. Duff is often deep. Stands may range in total downed woody fuel loadings from 0.7 to 38.6 tons/acre. Deep, moist undergrowth accounts for low flammability of surface fuels, but almost continuous carpets of ferns and regeneration increase susceptibility to torching. During moist and moderate summers these stands have very low probabilities of burning and may serve as fire breaks. But during

drought years these stands are subject to stand replacing fires that move in from adjacent, upland drier habitat stands.

***Role of Fire***—Forests in this group may persist for many centuries without stand-replacing fires, and severe fires from adjacent stands may stop at the edge of this biophysical environment. Valley bottom stands in South Deep appear to have burned less that surrounding stands. Most stand replacing fires probably do not originate in this group, but move in from surrounding stands. Recent fire exclusion has probably had no direct effect on this environment, but the most serious effect of fire exclusion is the increased likelihood of severe fire on adjacent lands, and therefore the increased likelihood of a severe stand replacing fire moving into the valley bottom stands. A severe fire could return these sites to herbs and shrubs and reforestation might take up to 200 years or more.

***Fire Management Considerations***—Where fire exclusion has increased the risk of stand replacing fire on adjacent sites, the likelihood of severe fire in valley bottom sites has also increased. Because of the rarity, esthetic appeal, slowness to regenerate, and the increased potential of severe fire moving into the stand from neighboring stands, fire/fuels managers may plan for protection of these sites.

### *Cold Mesic Subalpine Fir/Forb-Shrub*

***Fuels***—Fuel loading in cold mesic subalpine fir/forb-shrub biophysical environments can vary from 3 tons per acre to more than 35 tons per acre depending on species composition and age structure, fire history, natural thinning, snow breakage, levels of dwarf mistletoe and mountain pine beetle. An immediate source of dead material in a young lodgepole stand is the snags created by previous fire activity. Woody fuel arrangements are characterized by relatively large amounts of material 3 inches or greater in diameter. At least half of the total loading occurs in large material. Dense understories of spruce and subalpine fir often develop beneath the overstory. If heavy surface fuels lay beneath these understory trees, the hazard of crown fire is increased.

***Role of Fire***—Fire regimes in this biophysical environment are relatively complex. Large, stand-replacing fires burned through thousands of acres at intervals ranging from 117 years to 150 years. Although variable, the frequency of stand-replacing fires tended to decrease with increasing elevation because trees grow more slowly causing fuels to accumulate more slowly. Fires that started at higher elevations are usually lower in intensity; the stand-replacing fires were those that swept uphill from lower forests.

***Fire Management Considerations***—A history of stand-replacing fire is almost universal in this biophysical environment, but historic fires were variable in extent and behavior. Landscape diversity was greatest in areas characterized by small burns, but it also occurred within large burns due to variations in topography, vegetation and diurnal burning patterns. In this environment, pre-settlement fires burned more than twice as much area per year, on average, than fires have burned in recent years. Management ignitions can be used to increase variation in stand structure and reduce fuel loads, which may decrease the likelihood of prescribed natural fires turning into unacceptable wildfires in the future.

## Management Standards and Guidelines

The Forest Plan directs that fuel treatments will:

- Consider alternative methods of treatment for activity residues (logging slash) and natural fuels will be addressed at project level planning.
- Conform to air quality standards.
- Prepared burnplans for prescribed fire ignitions will be reviewed by the District Ranger.
- Provide for multiple resource benefits.
- Contribute to firewood availability.

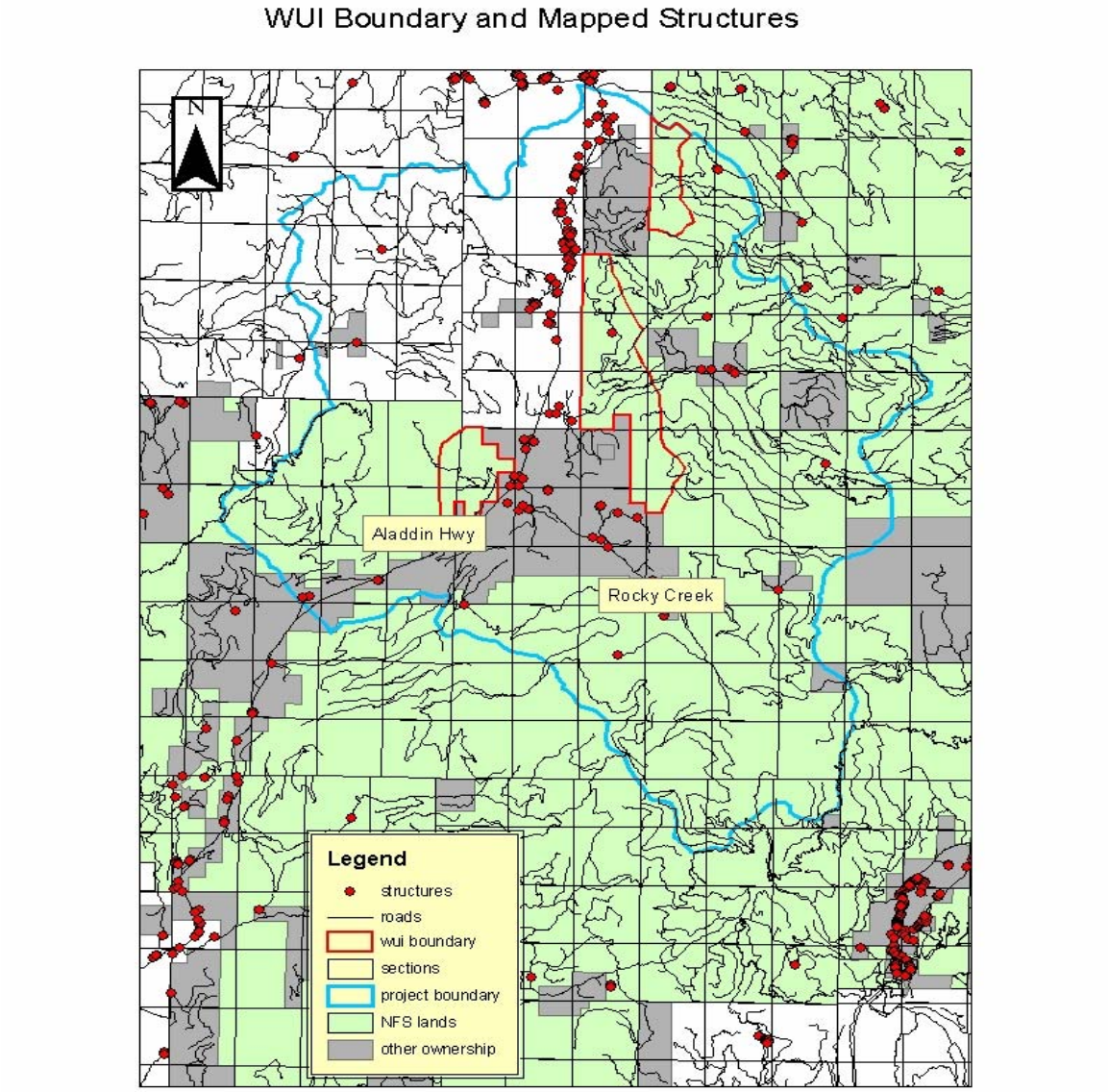
# Wildland Urban Interface

Wildland urban interface areas are defined as areas where humans and their development meet or intermix with flammable wildland fuels that may be vulnerable to forest or rangeland fires. In recent history the “wildland urban interface” has come into focus due to large uncontrolled fires moving out of wildland areas and into wildland urban interface areas causing damage and loss to human developments. These types of fires are becoming more common as humans move from urban and city settings to more rural settings, and as fuels buildup in the wildlands. Wildland fires do not have to be large fires to be of concern when they are in the wildland urban interface.

Aladdin Highway is the area of highest concentration of structures in the South Deep Management Project. There are private structures within 1 mile of the forest boundary along the road corridor adjacent to the forest. Other areas of private structures are along Rocky Creek Road, which also has multiple structures along the road, and Byers Creek area which has a ranch type facility within the forest boundary. Other structures shown on the map below within the forest boundary are generally abandoned homesteads including a restored recreation homestead along Meadow Creek Road.

Structures along the Aladdin Highway are mostly in the valley bottom ranchlands with some defensible space surrounding these homes, but there are other structures along hillsides located in dense vegetation. These structures in most cases have dense wildland vegetation near the structure with poor defensible space and may be at risk from wildland fire. Structures along Rocky Creek farther up the drainage in private lands are in a more mountainous environment and more susceptible to terrain related fire effects. Homes here are surrounded by thick vegetation and are often located on hillsides. These homes also are at risk from wildland fire. The Byers Creek structures are located in a large meadow, which is relatively open with defensible space surrounding the structures. Most older structures in the watershed are located in openings or on flat areas near water, whereas newer structures tend to be located on slopes and surrounded by vegetation.

As the map below (Figure 3.2) indicates, South Deep Creek watershed has a mixed ownership of private, state and federal lands. Within this watershed the Colville National Forest administers approximately 60% percent, and the total miles of national forest boundary is 46.32 miles. Approximately .75 miles borders Bureau of Land Management, 8.68 miles borders the Washington State Department of Natural Resources, and 36.89 miles border private property. The border of most concern is the boundary with private land ownership.




Forest Service representatives collaborated with members of the public to delineate the wildland urban interface boundary in the South Deep Project area. Wildland urban interface (WUI) boundary development incorporated the following steps:

- Boundary circles of 1 1/2 radius were drawn around clusters of homes or structures along Aladdin Highway[19].

[19] Clusters consist of 4 or more homes or structures.

- The boundaries that fell on National Forest System lands were moved forward or backward to the nearest strategic road or ridge, with the goal of averaging about 1 ½ miles from homes or structures.
- Vegetation treatments that fall within the WUI boundary are considered WUI treatments and are designed to address the key issues of the National Fire Plan[20].

Three areas were identified as WUI (Figure 3-2). The first area is in the north part of the project on the east side of Aladdin Highway. It covers approximately 2 miles of private boundary near the Meadow Creek Road. The second area is just south of the first area and covers approximately 5 1/2 miles of boundary. The third identified WUI area is west of the Aladdin Highway in the south end of the project area near Rogers Mountain. It covers about 3 3/4 miles of private boundary. Ridge tops were used as strategic points to stop wildfire in all 3 areas. The South Deep Management Project is neither within or adjacent to a community at risk nor does it have a completed Community Wildfire Protection Plan. Stevens County is currently developing a protection plan, but has not yet identified WUI boundaries.

# Air Quality Existing Conditions

The South Deep watershed lies within seven air miles from the city of Colville, and approximately six air miles from State Highway 20 and the Little Pend Oreille Lakes and recreation area. Smoke from prescribed fire and wildfires could temporarily impact visibility in all these areas, as well as subside into the Aladdin valley. Winter inversions are fairly common, and smoke, fog and smog often subside into the valleys and populated areas along the Aladdin Valley.

Smoke from prescribed fire and wildfire has the potential to impair air quality within and surrounding airsheds. The use of prescribed fire for ecosystem restoration can produce enough fine particulate matter to be a public health and welfare concern. Fine particulate in smoke can travel many miles downwind impacting air quality in local communities, causing a safety hazard on public roads, impairing visibility in class I areas and causing a general nuisance to the public. Prescribed fire also produces large amounts of carbon monoxide but this pollutant rapidly dilutes in the atmosphere and is only a concern to personnel in close proximity to the fire. If properly managed, most negative effects of prescribed fire smoke can be minimized or eliminated.

The Federal Clean Air Act, revised in 1991, is a legal mandate designed to protect human health, visibility, and welfare from air pollution. The act defines National Ambient Air Quality Standards as levels of pollutants above which detrimental effects on human health and welfare could occur. An area that is found to be in violation of National Ambient Air Quality Standards is called a “non-attainment area.” Pollution sources in these areas are subject to tighter restrictions. The city of Spokane lies approximately 90 miles to the south. Currently, Spokane is considered a Non-Attainment Area, failing to meet National Air Quality Related Values.

Particulate standards were originally defined in terms of total suspended particulate. More recently, the Environmental Protection Agency has changed the particulate standard to apply only to particulate less than 10 microns in diameter. This change was made because 10 microns in diameter is too small to be effectively filtered by the human respiratory system and much of it penetrates deep into the lungs. Small smoke particulates also have an especially long residence time in the atmosphere and scatter visible light, thus contributing to reduced visibility and regional haze.

The Clean Air Act also contains a provision called the prevention of significant deterioration. This provision was designed to prevent areas from being polluted up to the maximum point established by the National Ambient Air Quality Standards. Three air quality classes (I, II, and III) were established. Class I Airsheds are subject to the tightest restrictions. The nearest Class I Airshed is the Pasayten Wilderness Area in the Okanagon National forest, approximately 80 air

[20] See Chapter 1 for National Fire Plan objectives.

miles to the west of the Planning Area. The Pasayten will not be included in this analysis, as it is over 50 air miles away from the watershed area.

Burning is regulated by the Washington State Department of Natural resources to minimize the effects of smoke. Meteorologists permit smoke emissions according to the efficiency of atmospheric circulation to blow the smoke out of the area and dissipate the emissions. The Department of Natural Resources takes into account where smoke will move in the air patterns throughout the Pacific Northwest, and they also consider regional haze rules that prohibit additional emissions when haze standards are exceeded. When air is smoky, or has the potential to impact populated areas, no additional emissions will be permitted.

Based on past experience, the smell of wood smoke from prescribed fire may be detectable by the average citizen only occasionally in localized valley bottoms the morning after a burn. There have never been any reports returned to Fire Management personnel by citizens suffering adverse symptoms from prescribed fire smoke exposure on the Three Rivers Ranger District.

# Potential for Escape of Prescribed Fires

The possibility of prescribed fire escaping always exists. That possibility is mitigated by thorough planning and documentation in a burn plan for each burn. Each site-specific burn plan includes steps to be taken should a prescribed fire exceed its planned prescription and includes a geographical and resource contingency plan to bring the fire back into prescription.

All prescribed fire activities take place during spring or fall. Most jackpot burning takes place in springtime when soil moistures are high and soil temperatures are low. If jackpot burning is done in the fall it is only after significant moisture. Burning when soil moisture is high and soil temperature low means only a small amount of duff is consumed (10-20%) leaving very little exposed soil. The risks of escape can be mitigated by using common firefighting tactics to limit fire spread. Safeguards to contain fire may include firelines, black lines, wet lines, natural barriers, or roads. Burning is done when weather and fuel moisture conditions are such to make unmanageable fire behavior unlikely, such as during the spring or fall. Burns are monitored until they can be declared out.

Fireline will be used on all jackpot burning next to private land. Two kinds of fireline may be used depending on slope and access. If the slope is 35 percent or less machine line may be used. On steeper ground handcrews will construct hand fireline. Hoselays will also be used along with fireline in areas where risk of escape is high. Fire crews will also patrol areas along private to ensure the fire stays within the project perimeter. When there are high values at risk or there is a moderate risk of escape a night shift will be left on site to patrol the area throughout the evening until morning.

In many cases, if a fire escapes designated boundaries but is within a geographical area where limited ground fire spread may cause no harm and is still meeting resource objectives, then the fire will be monitored. In most cases, the fire either burns itself out or is put out by weather (rain or snow). If the controlled burn escapes into an area where fire is not desirable, or if the fire behavior is determined unacceptable, then control action is taken using resources on-site, plus, if needed, designated contingency resources are called. However, if a necessary holding action exceeds the capability of contingency resources, or poses a substantial threat to life, property or high value resources, a new strategy will be developed through a Wildfire Situation Analysis to guide further suppression actions.

The Three Rivers Ranger District has conducted controlled burns in logging slash for decades and in natural fuels since 1996. There has been one instance where a prescribed fire project escaped onto private land. The escape caused no damage and burned pine needles on less than an acre. No official action was taken by the landowner and no suppression cost was incurred. A big reason there are few escapes is the Forest Service has access to up to date spot weather forecasts, trained Burn Bosses, using detailed burn plans, managing unexpected

incidents, and having the authority to make better field choices according to field conditions. While the chance of an escape exists, its potential to occur and cause damage is lower due to increased administrative safeguards than were in place in the past.

# Cumulative Effects of Past Activities

## *Fire History*

Fire has always played an important role in the disturbance regime of the South Deep Analysis Area. During the pre-settlement era, (before 1860) fires were less frequent and larger than during Euro-settlement (1860-1910) (Schelhaas et al. 2000). Pre-settlement fire frequencies averaged 5.9 years. Mean fire frequencies dropped to 2.5 years during the homesteading era. Pre-settlement fire size averaged 520 acres, decreasing to 337 during the settlement era. After 1910, Forest Service Policy called for suppression of all lightening and human caused fires. The most recent large fires within the analysis area occurred during the 1920's and 30's. Densely stocked stands of small diameter trees resulted from these recent fires.

The South Deep watershed was "historically dominated by species more tolerant of fires such as western larch, ponderosa pine, and large Douglas-fir" (Schelhaas et al. 2000). This is a landscape different then the landscape of today. Reduced occurrence of fire in recent decades has allowed the watershed to move farther along successional trajectories and develop significant components of fire intolerant species such as western redcedar and subalpine fir. This extended fire free interval has allowed fire intolerant species to establish and grow vertically to create a fuel ladder to the existing overstory. The current vegetation is connected horizontally and vertically across the landscape, predisposing this area for fires that are of greater severity than those that occurred during the past several centuries.

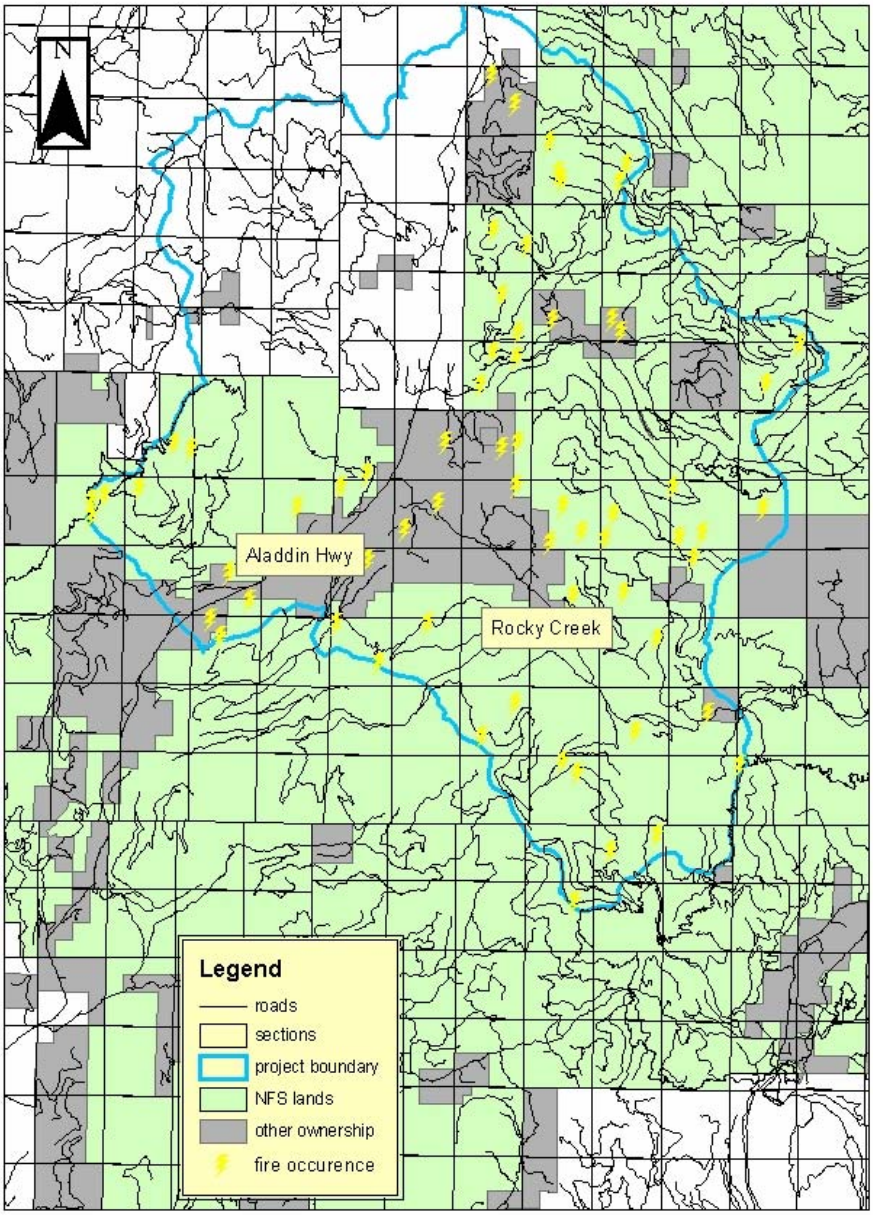
## *Recent Occurrence*

The map below (Figure 3-3) displays recent fire occurrences for the years 1944 to 2005 within the South Deep analysis area. There were a total of 63 fires during this period; 46 fires ignited by lightning and 17 human caused fires. The three largest fires, a 20-acre, 15-acre, and a 14-acre fire were human caused, one on private land and the other two on National Forest System lands. Thirty six of the remaining fires were spot fires, and the remainder varied in size from 1.8 to 0.04 acres. No fire was allowed to grow beyond 20 acres and no lightning caused fire was allowed to grow beyond 1.8 acres.

## *Air Quality*

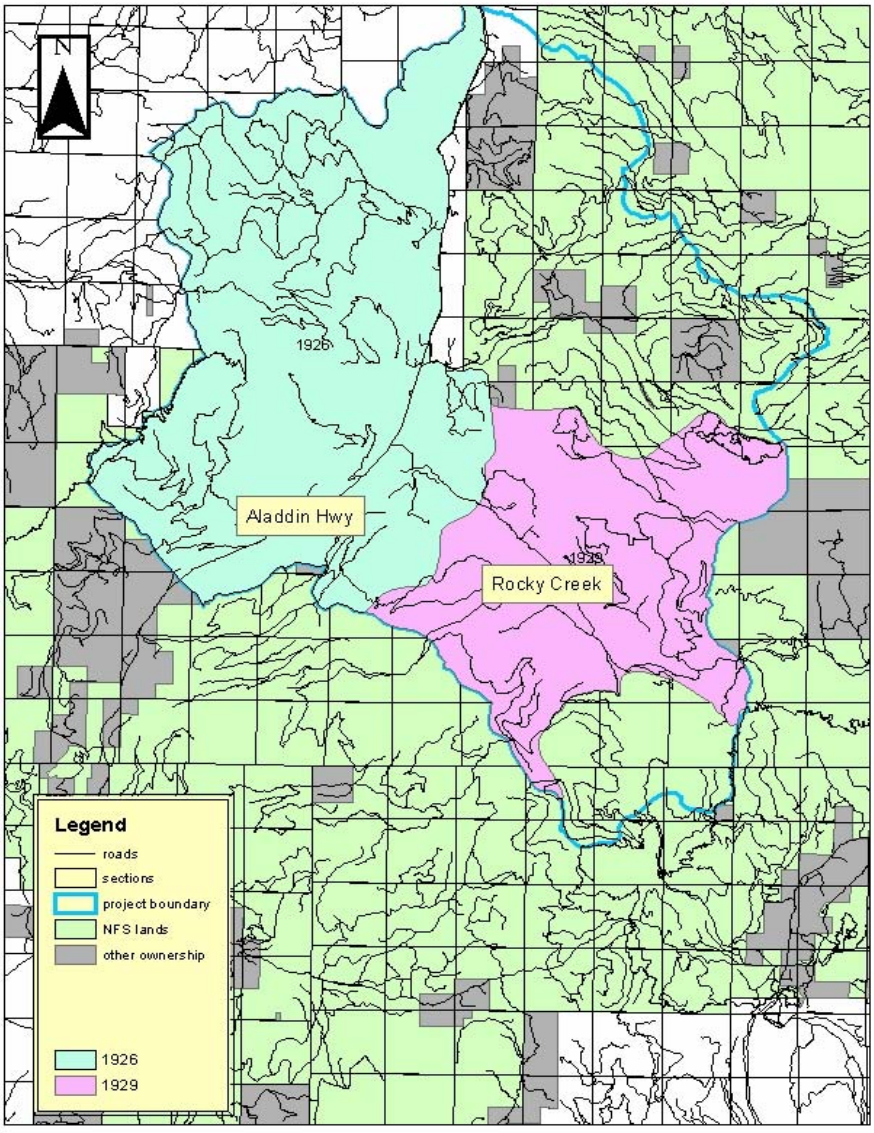
Air pollution from wildland fires has been a natural part of Pacific Northwest forest ecosystems for thousands of years. Prior to active fire suppression activities, an average of 800,000 acres would burn annually in the Pacific Northwest. Less than 5 percent of the total annual emissions of air pollution in the United States can be traced to wildfires. Prescribed burning contributes another half percent to the national total.

Fire Occurence



Known large fires in the South Deep watershed are displayed in the map below (Figure 3-4). There are only two years in the last 70 years in which large fires have occurred in the watershed. An additional large fire occurred close to the project boundary in 1934.

Fire History



By comparing recent fire history with the Schellhaas et al. South Deep Watershed Fire History Research report, it can be concluded that current fire occurrence (actual fire starts) may be within historical limits, but the return interval on which a parcel of ground is visited by fire is out of synchrony with historic mean fire frequency interval. This lack of fire presence may be directly attributed to a very successful fire suppression effort. It also accounts for the current densely stocked vegetation.

# 3.2 The Biological Environment

## 3.2.1 Forests: Affected Environment

The South Deep Creek watershed lies within the Okanogan Cool/Moist Forest subregion in the Northern Rocky Mountain-Steppe-Coniferous Forest-Alpine Meadow Province of the Northern Glaciated Mountains Ecological Reporting Unit (USDA/U.S. Department of the Interior [USDI] 1997),

Plant Associations vary throughout the analysis area with Douglas-fir, western red cedar, western hemlock and grand fir series represented. Tree species include Douglas-fir, ponderosa pine, western larch, western white pine, lodgepole pine, western red cedar, Englemann spruce, western hemlock, grand fir, subalpine fir, and hardwoods (cottonwood, aspen, and birch). Due to past fire and logging history, large areas of even-age western larch, lodgepole pine, and Douglas-fir exist. These seral species often occupy the overstory while Douglas-fir, grand fir, western redcedar and western white pine commonly occupy the understory in the seedling and sapling size classes. The fire origin stands resulted primarily from stand replacement fires in the 1900's. Stand ages are typically 70 to 100 years for the overstory and 10 to 20 years for the understory. These stands are predominantly overstocked and in the smaller size classes (less than 12-inch diameter at breast height). Remnant trees of ponderosa pine, Douglas-fir, western larch, white pine, and western redcedar are also present in the overstory. These trees usually occur where more moist conditions or larger, more fire tolerant trees were present. These remnant trees survived the stand replacement fires. Past harvest activities in the analysis area have removed some of these remnant trees.

Patches created by root rot over the past 20 to 30 years have been regenerated through natural seeding. Most of the natural regeneration is in shade tolerant species such as grand fir, western red cedar, western hemlock and intermediate shade tolerant Douglas-fir. To a lesser extent, especially on south to west aspects some of the regeneration has been shade intolerant western larch and ponderosa pine. Where existing residuals left by past entries or small patches created by root rot (primarily *Armillaria*) are providing shade, shade tolerant species are beginning to over top the shade intolerant regeneration.

Past harvest activity where the overstory was removed or hi-graded and the remaining suppressed understory retained, has left stands that are stagnated and genetically inferior to the original stand. These stands may never reach late and old structural stages without a disturbance event.

Fire exclusion and suppression in Douglas-fir and grand fir climax forests has perhaps been the single greatest detriment to landscape diversity (Hessburg et al. 1994). Allowing forest fuels to accumulate due to fire suppression will lead to severe, uncontrollable fires that threaten watershed, wildlife habitat, and scenic resources along with forest residential areas (Everett, 1994).

# Cumulative Effects of Past Activities

Current vegetation has been influenced by past fires, homesteading, mining and logging activity. Past fires and logging have created a mosaic of stands. These stands are primarily single storied. In some stands where the overstory has been reduced either by logging or natural disturbances (insects, diseases or windthrow), shade tolerant regeneration is becoming established in the understory. A major portion (66%) of the analysis area was burned by wildfires in 1926 and 1929 (see fire specialist report, South Deep Watershed Fire History Research, 2000 and the Watershed Analysis, 1999 for more information on fires in the analysis area). Very few large scale fires have occurred within the analysis area over the past 70 years. Forest vegetation, mainly trees that developed after the fires, were uniform in age and structure over thousands of acres. Extreme competition for site resources (water, light and nutrients) and an absence of disturbance has characterized growing conditions since the fires of the 1920's. Many of these stands resulting from the stand destruction fires are now densely stocked small diameter stands. Most trees in these densely stocked small diameter stands are less than 8 inches in diameter, and less than 10 feet from neighboring conifers. Many of the stands within the analysis area contain a majority of lodgepole pine, which is a relatively short lived species. The continuity and species composition characteristics of these lodgepole pine and densely stocked small diameter stands favor cyclic stand-replacing fires and consequently, their perpetuation. Densely stocked small diameter stands may limit the distribution and affect population sizes of native wildlife species that typically require a more open, large diameter forest habitat (South Deep Watershed Analysis 1999).

**Figure 3.5 Current Vegetation**

Bulldozer thinning was attempted in the 1960's and 70's to release[21] the overstocked densely stocked small diameter stands. Results from this practice were mixed with release occurring on some stands, while others had little to no release from the treatment.

Major plant associations in the analysis area are within the western redcedar, western hemlock, Douglas-fir and grand fir series. Other plant associations fall within the subalpine fir series. More detailed information related to the individual plant associations can be found in "Forested Plant Associations of the Colville National Forest" (Williams et al. 1995).

# Ecosystem Screening for the South Deep Watershed

The South Deep Creek Watershed Analysis (Shapiro and Assoc Inc., 1999) assessed conditions in the watershed and identified interrelationships between key ecosystem components which are used in this environmental assessment. Characterization of the landscape pattern of plant communities and seral stages were evaluated for the South Deep Watershed using stand structures and the historical range of variability developed by a team of specialists from the Colville and Okanogan National Forests and was based on conditions in the pre-settlement era. Historic range of variability calculations apply only to National Forest System lands (Devlin 1998, 1999).

The South Deep Watershed Analysis used a Regionalized Study to compare characteristics of the watershed with ecologically similar watersheds in the subregion. The regionalization study provides a different approach to characterizing the landscape than the current direction under Regional Foresters Amendment #2 (referred to as the Eastside screens). More detailed information on the regionalization approach is provided in the South Deep Watershed analysis.

[21] A treatment designed to free young trees from undesirable, usually overtopping, competing vegetation.

This regionalization study used a 25-inch tree diameter threshold to define the threshold of the large-tree strata and did not identify any old forest structural type stands (SS6 and SS7). However, Forest Plan Amendment #2, using a 21-inch diameter threshold identified approximately 1,025 acres of multi-stratum late structural type stands in the watershed. The following analysis is based on this Forest Plan amendment.

## Biophysical Environments

There are basically four biophysical environments within the analysis area: warm dry Douglas-fir/grand fir shrub (Group 3), cool mesic western redcedar/western hemlock forb-shrub (Group 11), cold dry/mesic subalpine fir shrub (Group 7), cool mesic Douglas-fir/grand fir forb-shrub (Group 5), and very moist western redcedar/western hemlock bottoms (Group 12). Biophysical environment groups 3 and 5 were considered interchangeable in the watershed and are included in group 5 for the purpose of this environmental assessment (Table 3.4). The role of fire in these biophysical environments is discussed in Section 3.1.3 of this chapter. Historically, late structural stage stands occupied at least 10-30+ % of the forested area in the South Deep watershed. Currently 3% of the project area is in a late structural stage. The Colville National Forest generally defines a late structural stand as having at least 8 trees per acre greater than 21 inches in diameter.

**Table 3.4 Biophysical Environments by Area and Percent**

| Biophysical Environment | Area | Percent |
|---|---|---|
| Cool Mesic Douglas-fir/Grand Fir Forb-Shrub (Group 5)/ Warm Dry Douglas-fir/Grand Fir Shrub (Group 3) | 10,181 | 34 |
| Cold Dry/Mesic Subalpine Fir Shrub (Group 7) | 2,597 | 9 |
| Cool Mesic Western Redcedar/Western Hemlock Forb-Shrub (Group 11) | 16,617 | 56 |
| Very Moist Western Redcedar/Western Hemlock Bottoms (Group 12) | 345 | 1 |
| Total | 29,740 | 100 |

### *Warm Dry Douglas-fir/Grand Fir (Group 3-included in Group 5)*

The forests in this biophysical environment usually consist of Douglas-fir and ponderosa pine, with western larch and grand fir on the more moist sites. Both tall and low shrubs dominate the understory and may include Oregon grape, baldhip rose, shiny-left spirea, serviceberry, common snowberry, oceanspray, ninebark, ceanothus, mockorange, prickly currant and western thimbleberry. Herbs found here are pinegrass, elk sage, strawberry, feather solomonplume, pathfinder, Piper anemone, queencup beadlily, Hooker fairybells and sweetroot.

#### Forest Succession

The most prevalent successional pathways produce open-grown ponderosa pine, and ponderosa pine/Douglas-fir communities; historically these communities were perpetuated by nonlethal underburns. A less common pathway occurs on cold sites occupied by Douglas-fir and grand fir habitat types where lodgepole dominates early succession.

Prior to modern times, stand-replacing fires were rare, and most stands were characterized by open, mature ponderosa pine, maintained by frequent nonlethal underburning. The fire frequency for these sites came often enough to maintain lower fuel loading and prevent fuel build-ups to where torching or crowning could occur. They were underburned often enough to eliminate fir regeneration while also thinning pine regeneration.

When the rare stand-replacing fire (or other disturbance) removes the overstory, grass species resprout rapidly; after a few years, the shrubs dominate. Moving through the succession of seedlings and saplings, low-severity burns will eliminate Douglas-fir and grand fir but leave some ponderosa pine; more severe fire (unusual in natural fuels but possible in activity fuels) can return the stand to grasses and shrubs.

Without fire, growth continues to the pole stage. Depending on initial stocking density, growth may be suppressed and a low-severity thinning fire unlikely. In moderately stocked stands, low or moderate-severity fires remove the fire-intolerant species and leave a thinned stand of ponderosa pine.

Should the stand mature without fire, ponderosa pine and Douglas-fir dominate, with an understory of Douglas-fir and grand fir. Nonlethal underburning can thin the overstory and remove understory trees as long as ponderosa pine and Douglas-fir are present. This becomes less likely as ladder fuels develop and overstory mortality increases the fuel loads on the forest floor. If fire is excluded for a long time, shade-tolerant species increase in importance and eventually dominate an uneven-aged stand. Low severity fires change these stands very little, but fires of moderate to high severity return these stands to grasses and shrubs.

## *Cool Mesic Douglas-fir Grand Fir/Forb-Shrub (Group 5)*

This group consists of cool, dry Douglas-fir and grand fir habitat types that have forb and shrub understories. Early in forest succession these habitat types are dominated either by dense lodgepole pine or by a mixture of Douglas-fir, ponderosa pine, and lodgepole pine. Grand fir is usually minor in early succession, but increases in dominance as stands of grand fir mature. Bearberry, Oregon grape, twinflower, Utah honeysuckle, baldhip rose, western thimbleberry, scouler willow, shine-leaf spirea, common snowberry, huckleberry, and snowbrush ceanothus are some of the shrubs found in this fire ecology group. The herbs found include queencup beadlily, strawberry species, sweetscented bedstraw, starry solomonplume, and round-leaf violet.

**Forest Succession**

Two major successional pathways are used to describe this process. In the first, early successional stands contain a mix of conifers; dominant species vary, but lodgepole pine does not dominate to the near exclusion of other species. In the second, lodgepole pine dominates for 100-150 years. Since these stands usually burn before the lodgepole seed source declines, they tend to regenerate to lodgepole pine after disturbance. Fire free intervals in stands dominated by lodgepole pine are usually less than 100-150 years. Longer fire free intervals favor mixed conifer forests. After canopy removal, forbs and grasses recover quickly; shrubs achieve dominance within a few years on many sites.

Fire severity plays an important role in forest succession. Depending on what stage of succession a stand has moved toward, low severity fire may either return the stand to grass and shrubs, or thin out shade tolerant species if at seedling and sapling stage. Unburned pole stands may develop into a stand of mature conifers as lodgepole pine decline in the overstory and lose reproductive capability. Low and moderate severity fires thin the trees and remove most of the spruce and grand fir. Repeated underburning, however, maintains these stands dominated by seral species. Without fire, shade-tolerant species eventually reach the overstory.

Severe fire can return these stands to herbs and shrubs, although relic individuals or clusters of Douglas-fir, ponderosa pine, and western larch may remain and influence the species composition of subsequent regeneration.

## *Cold Dry/Mesic Subalpine Fir/Forb-Shrub (Group 7)*

This habitat type can be found at elevations as low as 4,600 feet and as high as 6,900 feet. The sites are dry, often because of the position they occupy on the slopes. Subalpine fir and mountain hemlock are the climax species. Early succession is usually dominated by lodgepole

pine or a combination of other tree species, including Douglas-fir, Engelmann spruce, grand fir, western larch, western white pine, and whitebark pine.

Huckleberry, snowbrush ceanothus, Utah honeysuckle, prickly currant, willow, russet buffaloberry, twinflower and prince's pine are some of the more common shrubs found in this environment. The area is rich in herbs with queencup beadlily, round-leaved violet, sweetroot, and pinegrass.

**Forest Succession**

The composition and structure of seral stands in this habitat type depends on environmental factors and stand history. Three successional pathways are used to describe forest succession. In one pathway early succession is dominated by lodgepole pine. This pathway is likely to predominate in locations where fire return intervals have been shorter than the lifespan of the lodgepole pine. Another pathway describes succession dominated by Douglas-fir and lodgepole. This pathway is common on relatively dry sites and where occasional nonlethal underburns occur. Last, there is a pathway that describes more moist conditions, where western larch codominates with Doulgas-fir and Engelmann spruce. In this pathway the fire return intervals tend to be longer than the average lifespan of lodgepole pine.

## *Cool Mesic Western Red Cedar/Western Hemlock Forb-Shrub (Group 11)*

This habitat type is widespread on valley bottoms and lower slopes. It may also extend to elevations as high as 5,200 feet, and where precipitation is plentiful can be found on slopes of all aspects. These areas usually contain a mixture of climax species of western hemlock and western red cedar. Other seral tree species include: Douglas-fir, Engelmann spruce, grand fir, lodgepole pine, ponderosa pine, subalpine fir, western larch, and western white pine. Indicator shrubs and herbs include twinflower, big huckleberry, Oregon grape, thimbleberry, pachistima, and queencup beadlily.

**Forest Succession**

The path that succession is likely to follow in this biophysical environment depends on the site itself, the species present before the fire, the size and intensity of the burn, and postburn conditions. One pathway describes succession in stands where both seral and climax species become established soon after stand-replacing fire. This is common in stands with longer fire return intervals and moderate moisture and temperature regimes. On sites with poor drainage, shorter fire return intervals, and frosty temperatures, lodgepole pine occasionally dominates early succession in nearly pure stands. The pines are so dense and grow so rapidly that they overtake and suppress other conifers for many years. Finally, another pathway describes succession where moist climatic conditions, long fire return intervals, or uncertainties of seed source and fire effects enable shade-tolerant species to dominate immediately after disturbance.

## *Very Mesic Western Red Cedar/Western Hemlock Bottoms (Group 12)*

The habitat types of this biophysical environment occupy very moist sites in isolated patches. Most are in valley bottoms or on lower slopes with high water tables. Very large western red cedar and western hemlock trees dominate old-growth sites. Grand fir and Engelmann spruce are important seral species. On these moist sites, maple, alder, devil's club, scouler willow, and pacific yew can grow very large. Ferns, especially lady fern and oak fern are conspicuous in the understory. Other herbs are wild ginger, queencup beadlily, baneberry, pathfinder, sweetscented bedstraw, and starry solomonplume.

**Forest Succession**

These sites are usually too wet to burn thoroughly or dry out during prolonged drought and become vulnerable to stand-replacing fire. Since severe fires are usually accompanied by stand removal over a large geographic area, such fires may be followed by a significant rise in the water table. Such an environment favors species that can recover, taking as long as 200 years. The

tree species that establish depend on postburn conditions. Wet, cold sites favor Engelmann spruce and occasionally lodgepole pine. Subalpine fir may establish on well-drained, cool sites. Grand fir and western redcedar are limited to warmer conditions.

# Structural Stages

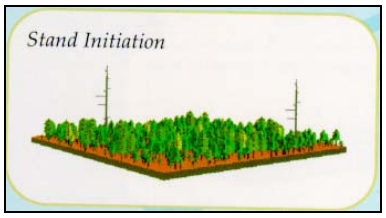
There are seven structural stages identified under the Regional Forester's Forest Plan Amendment #2: Revised Standards for Timber Sales on Eastside Forests (Lowe, 1995). All structural stages except structural stage 7 (single-stratum, with large trees) are represented in varying proportions in the watershed. Structural stages 1, 2, and 3 are considered an early structural stage of stand development. Structural stages 4 and 5 are considered a middle structural stage. Structural stages 6 and 7 are considered late or old structural stages. Variations in structural stages are a result of fire, insects, diseases, harvest disturbances, weather (precipitation level, wind, etc.) and stand development.

Some stands within the watershed could be classified as "untouched" by fire or logging. These stands may meet old growth or late structural stage definitions. Generally they are stocked with large Douglas-firs, western larch, and occasional ponderosa pine or Engelmann spruce. An intermediate tree layer exists, generally western larch, Douglas-fir, grand fir, or Engelmann spruce. The Polley Cabin stand which originated after a fire in 1751 contains large western redcedar and western hemlock with an intermediate tree layer of western redcedar, western hemlock and an occasional Engelmann spruce. Understory trees are usually shade tolerant such as western redcedar, Engelmann spruce or on drier sites grand fir. This may provide a glimpse of past vegetation within several of the biophysical environments in the analysis area. Untouched stands within the warm dry Douglas-fir environment show large ponderosa pine, Douglas-fir, and a few western larch trees. Many of these stands were undoubtedly park-like in nature. Most of these stands today have a proliferation of Douglas-fir in the understory.

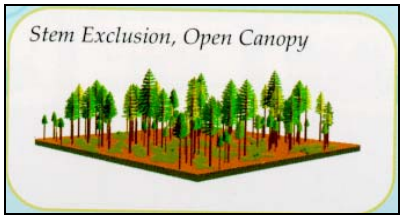
The following series of graphical examples (Figures 3-6 to 3-9) depict points of structural stand development in a mixed conifer stand type. Each stage is defined by language in the Regional Forester’s Amendment with considerations for local interpretation. Regeneration in harvested areas can be classified as stage 1, 4, or possibly 5 based on the number of leave trees and cohorts. The biophysical environment determines the ranges of each structural stage that indicate a sustainable landscape. The biophysical condition would affect the longevity of the desired landscape character. Single-Stratum Late Structure (SS7) is not found within all biophysical environments. Biophysical environment 2 and 4 contain SS7, biophysical environment 5 and 8 do not. SS7 in biophysical environment 4 would historically have occurred on western white pine habitat types.

## *Mixed Conifer Structural Stages*

Forest Structural Stage 1




Forest Structural Stage 2




Forest Structural Stage 3

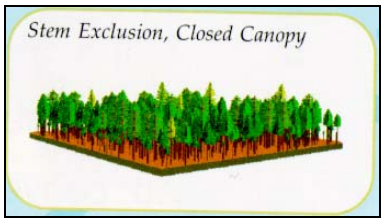



**Figure 3-6. Stand Initiation Through Stem Exclusion (Stages 1-3)**

These early stands are fully stocked by conifer trees that may range in size from seedlings through 15" diameter trees. The distinguishing characteristic is that all the trees are near the same age (same cohort), and all the trees are in the same canopy layer. A second canopy layer of shade tolerant trees has not yet started to develop in the understory.

Forest Structural Stage 4


Forest Structural Stage 5

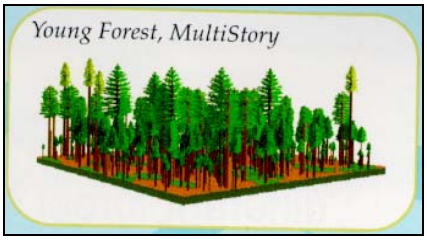



**Figure 3-7. Understory Re-initiation and Multi-Stratum without Large Trees (Stages 4-5)**

A second cohort of trees is established under an older overstory in these middle stages. Openings start to appear in the canopy, and the amount of down wood increases. The trees in the overstory are typically seral (larch, pine, Douglas-fir, etc.) while the trees in the understory are typically shade-tolerant (western redcedar, hemlock). The stand may contain many sizes of trees, but large trees are uncommon.

Forest Structural Stage 6

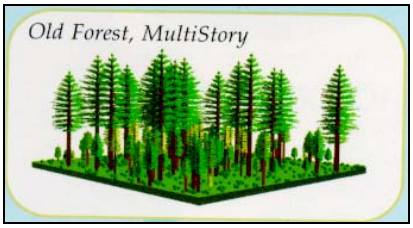



**Figure 3-8. Multi-stratum with Large Trees (Stage 6)**

These late and old stands contain two or more cohorts of trees, and trees of all sizes are present. The overstory canopy is discontinuous, and dominated by large trees.

Forest Structural Stage 7


**Figure 3-9. Single-Stratum with Large Trees (Stage 7)**

A single layer of large seral trees is present in this late and old stage. The understory may be absent or may contain sparse or clumpy seedlings and saplings. These stands are sometimes called park-like.

### Structural Stage Distribution

The following table (Table 3-5) identifies the existing condition of the analysis area in terms of percentages of area in each structural stage and the map shows the general location of the various structural stages.

**Table 3-5. Historic (H) and Current (C) Structural Stage Distribution by % of Biophysical Environment**

| Biophysical Environment | Early SS1, 2, and 3 | | Middle SS 4 and 5 | | Late and Old SS6 | | SS7 | |
|---|---|---|---|---|---|---|---|---|
| | H | C | H | C | H | C | H | C |
| **Group 5 and 3**: Cool Mesic Douglas-fir Grand Fir/Forb-Shrub / Warm Dry Douglas-fir/Grand Fir | 15-35 | 38 | 20-50 | 59 | 20-30 | 3 | 10-25 | 0 |
| **Group 7**: *Cold Dry/Mesic Subalpine Fir/Forb-Shrub* | 15-40 | 44 | 35-75 | 49 | 10-30 | 7 | 2-5 | 0 |
| **Group 11**: Cool Mesic Western Red Cedar/Western Hemlock Forb-Shrub | 10-30 | 31 | 20-50 | 66 | 30-70 | 4 | NA | 0 |
| **Group 12**: Very Mesic Western Red Cedar/Western Hemlock Bottoms | 5-30 | 33 | 10-50 | 67 | 30-90 | 0 | NA | 0 |

All the biophysical environments are outside the historic range of variability for the two critical late and old structural stages. As a result, proposed timber harvest on National Forest System lands in Biophysical Environments 5, 7, 11, and 12 cannot result in a net change of late structural stages. As appropriate for the site, multi-stratum late structural stage (SS6) can be treated to move to single stratum late structural stage (SS7). Harvest activities are allowed outside late structural stage stands if they manipulate vegetative structure in a manner that moves towards late structural stage conditions. Densely stocked small diameter and lodgepole stands are slowing the succession towards late and old structural stages. Reintroduction of fire and/or silvicultural treatments to reduce the overstocking will aid in moving the stands toward late structural stages. This is especially true in Group 5, which historically had a return fire interval of approximately 22 years with frequent low severity underburns. Frequent underburns would have favored ponderosa pine and western larch, while longer intervals favored Douglas-fir and grand fir (Smith and Fischer 1997). The greatest threat to western larch is the lack of forest disturbance i.e., fire or mechanical, to create the proper seedbed (Campbell and Liegel 1996). Regeneration harvest, in some cases, provides the best means to move the stands towards late and old structural stages. This is especially true in densely stocked small diameter and lodgepole stands, which would not adequately respond to a release treatment, such as a commercial thinning.

Several areas are outside the historic range of variability. The capability exists to move the middle structural stages to the late and old structural stages. In Group 5 where there is an increase in insect activity and root rot, there has been a lack of underburns or commercial thinning.

Past harvest activities and fire have reduced some of the late structural stage (stage 6 and 7) stands, and are the primary factor contributing to the early and middle structural stages. Insect outbreaks, such as the recent outbreak of the Douglas-fir beetle, have also contributed to the decline in structural stage 6 and 7 stands. It is difficult to track the data to determine which stands harvested met late structural stage, especially stands harvested in the pre-1970's. Salvage logging occurred that removed dead as well as many surviving remnants after the fires (Chance 1991). Past fires have created much larger scale disturbance events than the more recent timber harvest activities.

## Insect and Disease Disturbance

The current condition of the vegetation related to insect and disease levels and trends were determined by aerial insect and disease flights, field surveys by Jim Hadfield, Area Pathologist (2001) and Connie Mehmel, Area Entomologist (2005), stand exams, and walk-through exams, aerial photographs, and field reconnaissance by silviculturist. Insects and diseases are a natural part of the ecosystem. Historic conditions were low to moderate risk from insect and disease activity, depending upon the plant association and the time since a stand replacement event. Current stand health is at moderate risk levels due to increased stand densities. When stands are in good condition, there is adequate moisture, sunlight and nutrients for trees and insect and disease populations are low (endemic). However, when resources become limited as with overstocking or drought, forest pests respond by increasing populations and attacks. In severe cases, population levels may become epidemic. The current vegetation conditions of excess trees and continuous multi-story stands provide favorable conditions for forests insect and diseases.

Overstocked stands increase the level of risk for increased insect and disease activities. As basal area increases through time, risk of disturbances also increases. Overstocked stands that have significantly slowed in growth account for over 40% of the analysis area. These stands are considered high to moderate risk for increased insect and disease activity and should be considered a priority for future stand treatments. Another 15-25% of the analysis area will increase to a high or moderate risk over the next 10-30 years. A field visit with Jim Hadfield, (Area Forest Pathologist) was conducted in July 2001 and updated in 2005 by Connie Mehmel (Area Forest Entomologist) to review some of the high and moderate risk stands.

Insect and pathogen disturbances, once limited by vegetation conditions dictated by fire frequency and intensity, now freely extend to larger areas (Hessburg and others 1994).

With the exception of a few insects and pathogens introduced to this continent in the last century-notably the larch casebearer (Tunnock and Ryan 1985), the balsam wooly adelgid (Mitchell 1966), and white pine blister rust (Hagle and McDonald 1989), forests east of the Cascades have the same insect and disease associates now that they had 100 years ago. The difference between then and now is the scale of interaction between insects, pathogens, and their hosts, in both space and time. Although large insect outbreaks occurred before the European settlement of the West (Lieberg 1899, Swetnam and Lynch 1989, Wickman et al. 1993), the landscape patterns of vegetation ensured that most disturbances were brief and spatially confined. Some insects now appear to operate nearly continuously over entire landscapes (Hessburg et al. 1994).

An Assessment of the Ecosystem Components in the Interior Columbia Basin (Quigley 1997) found disturbances, such as those related to fire and insect mortality, have played an important role in determining forest composition throughout the interior Columbia Basin. In addition to natural disturbance, the Columbia Basin Assessment describes that land management activities and introduced pathogens have dramatically altered the species and age compositions of vegetation resulting from a natural disturbance regime.

### *Dwarf Mistletoe*

Currently, a major forest pathogen in the project area is dwarf mistletoe infection of western larch and Douglas-fir. Area pathologist Jim Hadfield (2001) found two species of dwarf mistletoe. Western larch dwarf mistletoe (*Arceuthobium* larcis) was found in 41 percent of the observations. Six percent of the stops had Douglas-fir dwarf mistletoe (*Arceuthobium* douglasii). Lodegpole pine dwarf mistletoe was not seen at any observations points. Stand exams reported low levels of infection. Infection levels are cause for concern for future growth loss and decline in stand vigor and impair future regeneration growth. This is especially true where regeneration is susceptible to dwarf mistletoe. An example is stands previously entered with harvest activities that retained an overwood of infected trees where the natural regeneration is susceptible to infection by the mistletoe. These existing units have a large component of western larch regeneration which is at high risk of becoming infected with dwarf mistletoe from the overstory. It

is possible that in some areas the locally adapted western larch seed source may be lost due to dwarf mistletoe (Flanagan). Fire has played an important role in reducing dwarf mistletoe populations (Andrews 1957).

Dwarf mistletoe reduces the growth and vigor of infected trees and eventually results in mortality. When infected, the tree responds by forming "brooms" where the infection stimulates growth. These brooms tend to fall off and can cause large build-ups of ground fuels especially in Douglas-fir where the brooms may also become ladder fuels. In addition, the brooms increase crown bulk density and provide a good means for spreading of crown fires. In the past it is likely that dwarf mistletoe was kept in check by fire burning up through the brooms.

## *Root Disease*

Root disease is also present and is more evident in older stands where mortality is occurring and also some of plantations that were regenerated primarily with Douglas-fir. *Armillaria ostoyae* followed by *Phellinus weirii* are the types most frequently encountered (Hadfield 1995). *Armillaria* root rot serves to maintain populations of Douglas-fir beetles because it provides a small but relatively steady amount of weakened trees and a few windthrown trees for the beetles to infest almost every year (Hadfield 1999). In presettlement forests, particularly those that experienced burns at intervals of 50 years or less, *Armillaria ostoyae* was present at low levels because there were not large quantities of freshly killed roots and stumps for it to colonize. The combination of selective harvesting and fire suppression, allowing invasion of more susceptible shade tolerant tree species, has greatly increased the food bases (large roots and stumps) available for the fungus. It has responded by colonizing these large woody substrates and subsequently has gained a lot of energy, technically referred to as "inoculum potential". This increase in energy has enabled the fungus to infect and colonize trees that in previous times would have been able to resist infection. All northeast conifers are susceptible to infection by *Armillaria ostoyae*. However, some species are more susceptible and experience more effects than others. Relative susceptibility is as follows: Susceptible- Douglas-fir, *Abies species*, spruce; moderately susceptible- lodgepole pine, hemlock, cedar; tolerant-ponderosa pine, western white pine, birch; Resistant-larch (Hadfield 1995). Prescriptions that reduce the amount of Douglas-fir in portions of the stands where armillaria is obviously present will reduce future losses to the disease. Thinning treatments to maintain or enhance the vigor of Douglas-firs should not cause the disease to become a problem (Hadfield 1999).

Stand exams identified widespread *armillaria* root pathogens and *schweinitz*ii root and butt rot, especially in dense multi-storied old growth stands with a heavy component of Douglas-fir. These diseases tend to cause mortality in patches. After the tree dies, the patches fill in with Douglas-fir and infection continues in the new stand.

## *Beetles*

Douglas-fir beetle (*Dendroctonus pseudotsugae)* outbreaks occur when an event such as a large wildfire or windstorm coupled with favorable weather and the presence of elevated endemic populations create conditions favorable for beetles (trees with thick phloem tissues for feeding but reduced resistance mechanisms). Outbreaks may occur over large areas, killing vast amounts of timber and creating fuel for catastrophic fires. Stands at the highest risk of beetle attack have an average diameter at breast height of greater than 14 inches, a species mix of greater than 50% Douglas-fir, and stand basal area exceeding 150 square feet per acre (Flanagan 1998). Prior to attack, stands are usually in structural stage five or six (multi-storied middle or old growth). Following attack, the stand may loose 60 to 80 percent of the largest trees returning the stand to a middle or early structural stage.

Surveys done on the Idaho Panhandle National Forests and the Colville National Forest in 1999, 2004 and 2005 suggest that the Douglas-fir beetle populations are declining (Mehmel (Letter) 2005, Flanagan, 1999). Parasites and predators (e.g. red belly clarids) of the Douglas-fir beetles were more abundant in 1999 samples than those examined in 1998. The role of these predators

is keep population levels at endemic. However, when an outbreak occurs, they are unable to keep Douglas-fir beetle populations level in check.

Although Douglas-fir and Douglas-fir beetles are native to eastern Washington, the recent outbreak (1997-2002) cannot be construed as entirely natural due to the significant changes in stand structure, composition, and hazard that have occurred as a result of human actions. This may be the largest recorded Douglas-fir beetle outbreak in the Pacific Northwest. The fuel buildup which will result from this outbreak should also not be construed as natural (Flanagan 1999).

In eastern Washington, Douglas-fir beetle outbreaks that begin from a single event such as fire or weather last approximately four years (Flanagen 1999). Outbreaks can be prolonged by drought, additional blowdown, defoliation by western spruce budworm or Douglas-fir tussock moth, and cambium damage as a result of logging or fires. Weakened trees become less resistant to insects and diseases, which then build up populations in these weakened trees and attack healthy trees as well (Oliver and Larson, 1996). When the triggering event occurred in 1997, resident populations of Douglas-fir beetles were already elevated (Flanagan 1999). Once an outbreak erupts, its severity and duration frequently are related to the abundance and susceptibility of the host species (Everett 1994).

As a result of this outbreak, several late structure stands were set back to earlier structural stages due to the beetle killing the large Douglas-fir tree component. The Beetle Mania salvage treated two units near Big Meadow Lake. In 2001, the district identified areas for beetle salvage but the project (North 40 Salvage) never implemented. These areas were considered for treatment in this project but most of the wood is no longer salvageable.

Mortality caused by the beetle tends to make large snags of the size favored by wildlife. The snags tend to stand for years and then fall adding to the down wood of ground fuel component. Firewood cutters often cut the standing beetle killed trees and can created large slash piles. These areas can be several acres in size and the amount of slash left precludes the establishment of seedlings as well as creates a fire hazard.

Current Douglas-fir population levels show a downward trend from the outbreak that started in 1997. However, Douglas-fir beetle is still active in areas where trees have become stressed by a pathogen such as *armillaria* root rot; fire damage, or due to close proximately to fresh large down material successfully colonized by beetles (in this case, high localized beetle populations continually attack neighboring trees and eventually the tree dies). Stand exams and aerial surveys have indicated the presence of high[22] endemic levels of beetle populations in the area throughout the last decade.

Mountain and western pine bark beetles are two insects that often move into early structural stands of dense lodgepole and ponderosa pine in this area. The stands most at risk are characterized as composed of fifty percent lodgepole pine per acre greater than 8 inches diameter at breast height, and densities of equal to or greater than 300 trees per acre. High densities stress the trees, encouraging successful bark beetle attacks. Bark beetles may kill the attacked tree within a year and move on to the next tree. Attacks usually start out in small patches and may move on to cover many acres. Mountain pine beetle has been active in the western part of the analysis area where acres of dense lodgepole pine and larch seeded in following fires in the early 1900s. Mortality greatly increases fuel loads and may allow the area to burn hot, bringing the stand back to the earliest structure.

Acres affected by mountain pine beetle increased from fewer than 1,000 in 2003 to over 11,000 in 2004. Many thousands of lodgepole pine trees have been killed: over 18,000 in 2004 and over 26,000 in 2005. This is occurring because lodgepole pine stands have reached an age and size that makes them susceptible to mountain pine beetle outbreaks (Mehmel (Letter) 2005).

[22] The term “high” describes insect and disease conditions that are not conducive to meeting Forest Plan objectives for Management Areas 3A, 5, 6, 7, and 8. (The Forest Plan for all of these management areas says: “Prevent or suppress insect and disease outbreaks which threaten the Management Area objective”).

Lodgepole pine stands that are older than 80 years with an average diameter at breast height of eight inches or greater are highly likely to experience outbreaks. Additional risk factors are basal area over 120 square feet per acre, and low elevation.

When a mountain pine beetle outbreak occurs in lodgepole pine stands, the beetles preferentially attack the largest diameter trees. Over the course of the outbreak, eighty-five percent or more of the large tree diameters are killed and progressively smaller portions of small diameter trees (Cole and Amman 1980, as cited by Mehmel 2005). Thinning can reduce the portion of the stand that will be killed by beetles, but stocking levels need to be less than 80 square feet basal area to be effective (Mitchell et al.1983). A light thinning in small diameter stands may just hasten the development of 8-inch diameter trees without keeping densities below a beetle susceptibility threshold (Cochran and Barrett 1998, as cited by Mehmel 2005).

Since 2001, the extent and intensity of fir engraver and mountain pine beetle activity has increased substantially (Mehmel (Letter) 2005). Fir engravers are most likely to initiate successful attack in trees that are under stress (Mehmel (Letter) 2005). They are particularly association with root disease (Land and Goheen 1979, as cited by Mehmel 2005). Trees stressed by root disease are less able to produce defensive chemicals against bark beetle (Mehmel (Letter) 2005). Currently, fir engraver (*Scolytus ventrailis*) is killing grand fir in the project area, especially in the Rogers Mountain area.

Spruce beetle and western balsam beetle on subalpine fir are found in minor amounts in the analysis area.

Western white pine blister rust is and has caused widespread mortality in all age classes of western white pine throughout the analysis area. Current estimates are that western white pine occupies about 1/2 to 2/3 less area than it has historically occupied (DeSpain 1996, as cited by Mehmel 2005). The loss of western white pine has led to an increase in Douglas-fir, which in turn led to significant *armillaria* root disease problems (Flanagan 1997).

Although a minor species component in the project area, about one-third of Hadfield's (2002) ponderosa observations were infected with *Elytroderma* needle blight. This disease, although not nearly as destructive, is similar to dwarf mistletoe in that it forms brooms. The brooms tend to stay on the tree longer and are filled with dead needles making the foliage very susceptible to crown fires.

In 1992, the Polley Cabin area had high levels of larch needle blight (*Hypodermella laricis*) and some larch needle cast (*Meria laricis*). These needle funguses had spread due to the moist spring and summer conditions *down* through the Rocky Creek basin. In 2001 several needle disease were again found within the analysis area: *Rhabdocline* needle cast of Douglas-fir, *Elytroderma* needle disease in the ponderosa pine, larch needle cast in western larch, lodgepole pine needlecast and *Delphinella* blight in subalpine fir. Repeated infection may cause growth loss and, rarely, mortality. *Delphinella* blight is not likely to have any effect on growth or longevity of the subalpine fir.

During this century Douglas-fir, grand fir, and western hemlock have been replacing western white pine, western larch, and ponderosa pine in northeastern Washington State and stand densities have also increased (Lehmkuhl et al. 1994). Reasons for these changes as previously mentioned include fire suppression and exclusion, white pine blister rust, and selective logging. Many dense stands are now dominated by Douglas-fir and infected with *Armillaria* root disease, caused by *Armillaria ostoyae*. Douglas-firs infected with *Armillaria* root disease are predisposed to attack by Douglas-fir beetles. Some additional Douglas-fir that have been unsuccessfully attacked may eventually succumb to the pathogenic blue stain fungus, *Ceratocystis pseudotsugae*, after being successfully inoculated by Douglas-fir beetles, but it may take several years (Kegley et al. 1999).

With the exception of a few insects and pathogens introduced to this continent in the last century—notably the larch casebearer (Tunnock and Ryan 1985), the balsam wooly adelgid (Mitchell, 1966), and white pine blister rust (Hagle and McDonald 1989), —forests east of the Cascades have the same insect and disease associates now that they had 100 years ago. The

difference between then and now is the scale of interaction between insects, pathogens, and their hosts, in both space and time. Although large insect outbreaks occurred before the European settlement of the West (Lieberg 1899, Swetnam and Lynch 1989, Wickman et al. 1993), the landscape patterns of vegetation ensured that most disturbances were brief and spatially confined. Some insects now appear to operate nearly continuously over entire landscapes (Hessburg et al. 1994).

Acres in the early structural stages are generally free of the insects and diseases that favor dense multi-canopy late structure forests. However, as stands grow they become overly dense, especially without frequent underburning or precommercial thinning. Overstocking causes high levels of stress on individual trees and stands by exceeding the site's capacity. Stand density index curves indicate a threshold of imminent mortality, where trees begin to die. Forest pathogens may move in just prior to this point, accelerating tree mortality.

An Assessment of the Ecosystem Components in the Interior Columbia Basin (Quigley 1997) found that disturbances, such as those related to fire and insect mortality, have played an important role in determining forest composition throughout the interior Columbia Basin. In addition to natural disturbance, the Columbia Basin Assessment observes that land management activities and introduced pathogens have dramatically altered the species and age compositions of vegetation resulting from a natural disturbance regime.

## Climate Change

Changes in global climate toward a warming trend may impact the existing patterns of forest trees in the following ways:

During periods of above average precipitation, some species of forest trees, such as Douglas-fir, are able to regenerate and successfully compete. Warmer drier summers would be expected to stress trees sufficient to cause a shift in their ability to compete and increase susceptibility to forest pathogens.

Similar to trees stress by root disease, trees stressed by drought are less able to produce defensive chemical against bark beetles. Low precipitation in 2003 (86% of normal) made trees more susceptible to bark beetle attack during the 2004 growing season (Mehmel (Letter) 2005). Low precipitation in 2005 (81% of normal) will probably resulted in increased bark beetle successful attacks in 2006 (Mehmel (Letter) 2005). An example of this can be seen in the Rogers Mountain area, where fir engraver beetles have caused high levels of mortality in grand fir. Another example is the increase in lodgepole pine mortality.

Individual tree species distribution and subsequently plant associations would adjust along the lower end of their ranges.

Warmer spring seasons may increase the growing season length allowing more growth to trees and other vegetation. This is expected to be especially noticeable in natural meadows, which will tend to be colonized by tree and woody brush species. But it will also occur in the drier forest types where growing space is available. Although this ingrowth is commonly attributed to fire suppression there is a growing opinion that it is partially due to climate change (PNW Res. Sta. Sci. Update Jan 2004). While the increase in season is likely to increase height growth, diameter growth is likely to be reduced since diameter growth starts later in the season than height growth and tends to terminate with adverse conditions such as drought (Hall 1987).

Long-term climate studies show that the period from the early 1930s to the present time has been one of the driest times recorded. Weather conditions during that period were conducive to catastrophic fires. These conditions may have increased the potential for creating dense stands.

Climate change directly influences the timing and likelihood of severe weather occurrences, especially wildfire. Climate change is expected to exacerbate the instability of the South Deep watershed by increasing vegetation ingrowth and densities, changing vegetation types and

species survival in the lower parts of their range, increasing insect outbreaks resulting in subsequent snags, and increasing the likelihood of wildfire after ignition.

# Cumulative Effects of Past Activities

## *How Has Harvesting and Fires in the Early Part of the 1900's Affected the Forest Vegetation*

The prevailing climatic conditions combined with a series of large wildfires in 1926 and 1929 and the land uses of timber harvesting, homesteading and livestock grazing have created the current patterns of forest, grassland, and riparian vegetation within the South Deep analysis area. Today much of the valley bottom along South Deep and lower Rocky Creeks is owned by rural residents and used primarily for farming and livestock grazing. Most of the northwestern portion of the watershed west of the Aladdin Highway is industrial forest land.

Past timber harvest in stands with sawlog-sized trees has fragmented much of the watershed by creating smaller patch sizes than have been represented historically. Current mean patch size in the watershed is 98 acres, whereas the natural range of variability ranged from 76 to 1,052 acres (South Deep Watershed Analysis 1999).

Inherent disturbance regimes in this area include fire (both stand replacement and mixed severity and low severity), insects and plant diseases (South Deep Watershed Analysis, 1999). The analysis area was homesteaded during the early part of the 20th century. During that era logging and agricultural uses occurred throughout the analysis area, including areas that eventually became National Forest System lands. Land that was less suitable for agriculture and homesteading was returned to the Federal Government between1930 to1940 and became the Colville National Forest. Parts of what is now National Forest System lands were cleared for cattle grazing and cultivated for crops (mostly hay).

Logging was an important part of the economy in the early 1900's and favored removal of western white pine and western redcedar (Watershed Analysis, 1999). By 1910, approximately 100 sawmills operated in Stevens County, producing an annual output of 62 million board feet valued at over $7 million. The timber industry was delivered a serious blow in 1926 and 1929 when approximately two-thirds of the watershed burned within three years.

The stand destruction fires in the 1920's removed most of the timber available for harvest. Some of the residual trees that survived the fires were then logged to support the local mills. Some of these residual trees if not harvested would still be alive today. One stand that survived the fires and was not harvested is in the Polley Cabin area.

In the 1960s to early 1970s, bulldozer thinning was conducted on many acres of National Forest System land. This was designed to reduce overstocking and improve tree vigor, and was motivated in part by a program through the U.S. Department of Commerce to provide work for the unemployed (Findley et al. 1998). During the1970s stand management began to focus more on "partial cutting" involving overstory removals and sanitation/salvage types of harvest, but removal of the larger tree component was still the norm during this period.

Dozer thinning typically consisted of running a tractor over the standing vegetation - including the trees - in strips that were typically 10-20 feet apart. Areas treated with dozer thinning include the headwaters of Rocky Creek, Blacktail Butte area between Polley Creek and Rabbit Creek, Aladdin Mountain, Kenny Creek, and upper Scott Creek. Dozer thinning appears to have occurred on about 25% of the National Forest System lands within the planning area[23] and is visible today by a "combed like" pattern of tree spacing.

[23] Rough estimate based on reviews of the 1972 aerial photos by Nancy Glines, Soil Scientist, 2006..

As some stands that originated after the forest fires of the 1920s grew to commercial size, timber harvest activity in the watershed increased during the 1970s and 1980s (South Deep Watershed Analysis 1999). Boise Cascade Corporation began to actively manage their lands in the northwestern part of the watershed, as did the National Forest System. Today most of the area is second-growth timber. Intensive timber management by the Forest Service began in the 1970's. Timber management included both commercial harvest and treatments to improve the condition in the densely-stocked, small diameter stands. Entries made in more recent decades have been a mix of stand replacement, overstory removal, shelterwood, thinning and selection cutting. Some stands have been entered more than once for timber harvest. Relatively few stands have been entered since the 1970s for noncommercial vegetation management activities such as prescribed burning and precommercial thinning. Many of the roads in the watershed on National Forest System land were constructed during this time to access timber sale areas (Lynn pers. comm. 1999).

Roughly 70 percent of recent harvesting was completed during the 1980s and 1990s. Approximately 60 to 70 percent of harvest prescriptions were clearcuts or clearcuts with reserves Chart 3-6). Thirteen Forest Service timber sale units were logged between 1983 and 1992. The resulting plantations are stocked with conifers and shrubs.

In 1993 the eastside screens were put in place as an interim directive until 1995 when they were revised and were amended to the Forest Plan by the Regional Foresters Amendment. In 2001 the National Fire Plan was put into place to prioritize and fund activities that would mitigate the growing threat of wildfires to life, property, and resources. The Healthy Forests Initiative (HFI 2000) and the Healthy Forest Restoration Act (HFRA 2003) modified administrative procedures and processes governing preparation of projects to reduce hazardous fuel and restore healthy ecological conditions.

Commercial timber has been harvested on roughly 21,000 acres in the South Deep analysis area since World War II (Table 3-6). Most of this harvesting was done with tractor yarding systems, and the majority occurred on state and private lands. The following table displays information about past logging.

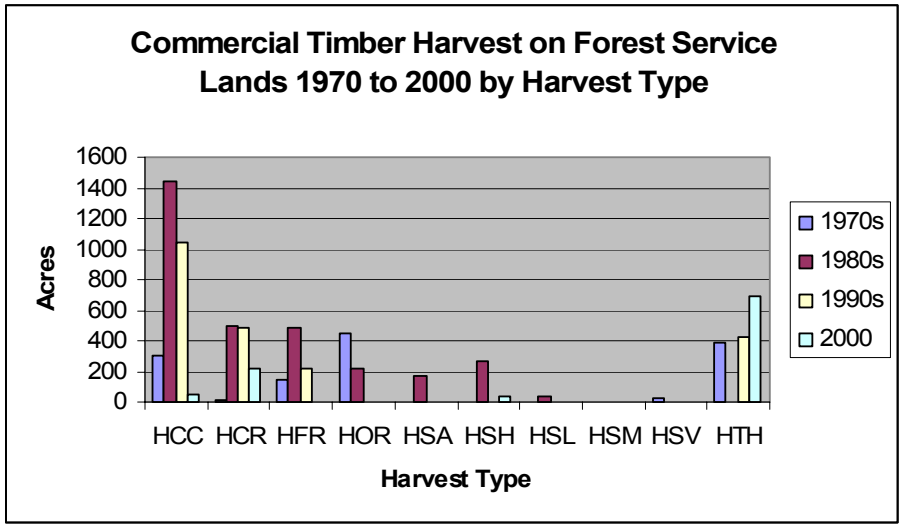
**Table 3-6. Summary of Past and Planned Logging in the South Deep Analysis Area**

| | Acres |
|---|---|
| Total acres harvested.<br>41% of the total analysis area has had commercial timber harvest. | 20,949 |
| Harvested on private and state lands.<br>63% of the private, state and BLM lands have had commercial timber harvest. Most occurred on private lands. Figure includes State forest practice permits between April, 2002 and December, 2005 show 4, 639 acres planned. | 12,789 |
| Harvested on NFS lands.<br>27% of the NFS lands have had commercial timber harvest. | 8,160 |

Starting in the 1970s, regional standards were set for seed transfer and planting stock to be used for artificial reforestation. Between 1970 and 2000, roughly 2000 acres were artificially regenerated with Douglas-fir and western larch or a mix of these species. The seedlings used to reforest these areas are from genetically improved stock. The planting mix often contained western white pine, Englemann spruce, and ponderosa pine. Natural regeneration is intermixed with planted trees. A few clearcuts as well as salvage cuts regenerated naturally with the local seed source. Survival and growth were monitored to meet guidelines. The trees in these plantations offer opportunities to move stands toward the desired mix of species and structures.

Management activities have changed the relative amounts of various species, but the combination of natural regeneration and planting has maintained a diversity of species within the planning area.

Chart 3-6. Summary of Acres by Commercial Timber Harvest by Decade on Forest Service Lands




Potential regeneration problems from past harvests in this area include brush competition, mortality caused by blister rust or *Armillaria* root rot and damage due to foraging by wildlife. Some of the past regeneration harvests have required a replant to certify the unit as restocked. Planting techniques and seedling survival has increased over the years and percent of regenerated acres satisfactorily stocked after 3 years on the district have ranged from 83 to 94%.

Some of the ponderosa pine within the watershed was brought in from the Black Hills of South Dakota. These ponderosa pines were planted following the fires and salvage efforts in the 1920's and early 30's. These older ponderosa pine plantations are experiencing very high mortality from root and needle pathogens because of the off-site seed source. These poorly adapted off-site trees have reached sexual maturity, and their genes are contaminating the native ponderosa pine stands through the spread of pollen and seed (DeWald and Mahalovich 1997).

Fragmentation of the watershed (primarily from timber harvest) could increase the potential for uncontrolled wildfire. Fragmentation tends to distribute fire-prone stands across the landscape, placing fire-resistant types within an unsustainable matrix of susceptible stands. In the South Deep Creek watershed, the stands are highly fragmented compared with reference conditions. Patch sizes tend toward the lower part of the reference range (smaller patches are a further sign of fragmentation). Without management intervention, these areas can be expected to become more susceptible to large-scale stand replacement fires. Fragmentation could also intensify the spread of dwarf mistletoe by increasing the exposure of young trees to the spread of the pathogen from taller infected trees in nearby stands. Management is likely to increase future fragmentation because of the emphasis on small stand sizes and alternative harvest methods.

Past harvesting resulted in various changes in the forest cover. Openings made by even-aged cutting have ranged from a few acres to over a hundred acres (Industrial forest lands and Byers Creek, Paradise, and Rocky4 on National Forest System land). They have persisted as openings or partial openings for up to two decades with a few more recent cutting units still in transition to a fully forested cover condition. A mix of small openings (less than three acres) and more open stand conditions initially resulted from overstory removals, basal area reductions, and shelterwood cuttings that focused on removing larger, mature trees or lodgepole pine infested

with bark beetles. Such open stand conditions are persisting for approximately one to three decades depending on the vigor of residual trees and ingrowth of new seedlings and saplings. In some cases, dense established understory trees have remained on sites that are stunted and currently growing very slowly. Areas selectively harvested or thinned to remove defective or suppressed trees have become and remain more open and vigorous in proportion to the amount of stocking reduction and capacity of the residual trees to respond to release. Results achieved from these types of treatments vary widely across the analysis area. Most of the units in Rocky Timber Sale that were commercially thinned in the 1990s have not shown improvements in diameter growth.

## *Livestock Grazing*

The project area contains all or portions of three livestock grazing allotments. Rocky Creek does not contain an active grazing allotment. The Aladdin, Meadow Creek, and Smackout allotments can be characterized as forested rangeland or transitory range[24] which provides food, water, and cover for domestic livestock. Harvested or precommercially thinned stands of forest trees have the potential to provide increased forage production and thus can reduce grazing pressure on primary range.

Cattle grazing can produce both negative and positive effects for silvicultural projects. Protection from direct damage to both planted and natural regeneration is a concern when cattle graze plantations. The first years of establishment of a plantation are the most critical. Any damage to seedlings will impact them throughout their life. On harsh sites, where regeneration is sparse or difficult to establish cattle grazing is generally considered incompatible with regeneration efforts until there are enough trees established, which are well distributed, that tree stocking will continue to be adequate after grazing impacts (USDA FS 1982, cited by Kingery et al. 1987).

Based on review of reforestation stocking surveys, field review of plantations, recommending and certifying restocking of forested lands on harvested units, no effects from cattle grazing were observed that would result in a failure to meet regeneration objectives in the Aladdin Allotment Complex. No known problems with plantation failures could be attributed directly to cattle grazing. The condition of hardwood trees within the Aladdin Grazing Complex has been characterized as declining (Hadfield et al. 2006). Although browsing of aspen sprouts and other hardwoods occurs in the allotments, it was only identified as a limiting factor along Smackout Creek between pastures 1 and 4. Beneficial effects from cattle grazing, such as reducing losses due to fire, are very difficult to ascertain. Timber harvesting in the allotment complex has created transitory range and, thereby, improved the overall forage condition. Transitory range in the allotment complex has reduced grazing pressure on primary forage. This is most notable in the Smackout allotment where cattle graze forested land the majority of the season. In a few cases timber harvesting has necessitated the construction and maintenance of additional fences and cattle guards by breaking existing barriers to cattle movement.

## *Fire Exclusion*

In fire recurrent areas, fire accomplished stocking control, enhanced the forest mosaic by increasing horizontal diversity among patches, simplified vertical structure within patches and maintained early seral vegetation. Patches that are vertically well stratified enhance micro-diversity but are optimal for damage by mistletoes and two major defoliators. Both *Armillaria* root disease and laminated root rot have expanded from their historic centers to colonize Douglas-fir trees, which are now prevalent throughout mature stand types. Pathogen and insect populations are building in response to the increased availability of the preferred host in stand structures and over large contiguous areas of the landscape that are optimal for their dispersal.

[24] Transitory range is land which produces suitable levels and composition of livestock forage or can temporarily provide such forage as a result of a disturbance event such as fire, or harvest activities (FSH 2202.21 and FSM 2200).

Excluding fire from Douglas-fir and grand fir climax forests has perhaps been the single greatest detriment to landscape diversity on the eastside (Hessburg et al. 1994). Earlier forest ecosystem structures (dependent upon fire) were healthier and more desirable than present structures (Everett, 1994).

Fire exclusion has probably allowed rocky sites to become forested where they may have supported brush under a short fire-return interval fire regime.

Ponderosa pine is a minor component throughout the analysis area. Many of the ponderosa pines are declining due to stress from overstocking and encroachment from more shade tolerant species. The ponderosa pines are also at risk from fire caused mortality unless the current fuel loads and risk of a stand replacing fire event are reduced.

Without fire exclusion, these stands probably did not have the homogeneity which we see today. Harvey et al. (1999) suggests that fire suppression has changed the location of nutrient pools moving nutrients from the soil and high canopy to the forest floor and low canopy trees. This shift in nutrient pool and organic matter load could make sites, especially sites with a short fire return interval, more vulnerable to nutrient losses from fire. These changes have probably affected species composition and growth.

### *Roads and Rock Pits*

The planning area has three rock pits on National Forest System lands. The Byers Creek pit is about 3 acres. The Thomas Mountain quarry is located outside of the project area and is roughly 11 acres.

Pit sites falls under the Code of Federal Regulations 36 (219.14) which states “lands which are not suited for timber production shall be identified in accordance with the criteria in paragraphs (a) (1) through (4) of this section shall be identified as not suited for timber production”.

The irreversible commitment of the extraction of rock and gravel is permitted by the Forest Plan (FEIS, Colville National Forest, IV-141). The condition class map will be updated to attribute the site as five acres of non-forest.

Areas converted to roads and rock pits are generally considered “removed from the productive landbase”. The South Deep Analysis area has about 220 miles of road. The roads vary from single-lane dirt tracks to one two-lane paved road (Aladdin Road). Width varies from about 20 feet to more than 60 feet. Roads and rock pits occupy about 3% of the planning area.

## Old Growth

Due to logging in the late 1800’s and early to middle 1900’s, and stand destruction fires in the 1920’s, large areas of even-aged western larch, lodgepole pine, and Douglas-fir exist in the South Deep watershed. Stand ages are typically 70 to 100 years old for the overstory with an occasional western larch, Douglas-fir, western red cedar, western hemlock or ponderosa pine remnant reaching 150+ years old. These living remnants and all live trees more than 21 inches in diameter at breast height have been identified to be retained for current and future diversity (Lowe, 1995).

The analysis consisted of Region 6 and walkthrough stand examinations on a portion of the area. Reconnaissance of the area by utilizing aerial photographic interpretation techniques was conducted in the remainder of the analysis area. As designated by the Regional Forester in a letter dated December 3, 1992, and by the Forest Supervisor in a letter dated April 5, 1993 the planning area was analyzed using the North Idaho Zone definitions for old growth stands. Four stands within the analysis area were identified as North Idaho Zone Old Growth.

The Regional Current Vegetation Database was searched for the South Deep Project Planning area for additional information concerning Old Growth. The plots are five-point clusters designed for Continuous Forest Inventory and not designed as stand-alone data. A plot which appears to

meet North Idaho Zone Old Growth Standards may or may not indicate an old growth stand is present. However, it may serve as an indication of the amount or distribution of old growth trees or groves within the area. Twenty-eight plots have been located in or close to the South Deep Project Planning Area. Of that total, one was found to have North Idaho Zone old growth characteristics, and another one was found to be very close to meeting that standard. Neither plot was located inside of an area proposed for harvest treatment in the South Deep Management Project.

**Table 3-7. Stands currently identified as North Idaho Old Growth**

| Vegis-Code | Acres |
|---|---|
| 1000298 | 47 |
| 1004779 | 37 |
| 1004781 | 45 |
| 1005137 | 32 |
| **Total_Acres** | **161** |

Data Source: acres based GIS stand-structure theme.

Approximately 161 acres or less than 1% of the analysis area has been identified as meeting North Idaho old growth condition (Table 3-7). No old growth stands are proposed for treatment within the analysis area. If any stands are identified as old growth during future reconnaissance or unit layout, they will be added to this list and excluded from any harvest activity.

## Land Suitability

The Timber Land Suitability Map utilized by the Colville National Forest during the land management planning process identified unsuitable areas. Using field reconnaissance, aerial photo interpretation and the Timber Land Suitability Map, 1,173 acres, or approximately 4% of the planning area, is currently identified as unsuitable for timber production.

The Code of Federal Regulations (CFR) 36 (219.14) states that "lands which are not suited for timber production shall be identified in accordance with the criteria in paragraphs (a) (1) through (4) of this section shall be identified as not suited for timber production:"

1. The land is not forest land as defined in CFR 219.3.
2. Technology is not available to ensure timber production from land without irreversible resource damage to soils productivity, or watershed conditions.
3. There is not reasonable assurance that such lands can be adequately restocked as provided in CFR 219.27(c)(3).
4. An Act of Congress, the Secretary of Agriculture or the Chief of the Forest Service has withdrawn the land from timber production.

No stands identified as unsuitable are proposed for treatment within the project area.

# 3.2.2 Sensitive Plants: Affected Environment

No federally listed threatened or endangered plants or plants proposed for federal listing are known to occur in the analysis area. Forty-five plant species listed on the Regional Forester's Sensitive Species List are documented or suspected for the Colville National Forest. Seven of these in 14 populations were known from the project area: *Botrychium crenulatum, Botrychium hesperium, Botrychium paradoxum, Botrychium pedunculosum, Carex flava, Cicuta bulbifera* and

*Geum rivale*. In addition, potential habitat exists in the analysis area for another 22 suspected sensitive plant species.

During the pre-field review, species that normally occur well below the elevation range of the project area or those where typical habitat is not present are omitted from further analysis. Field reconnaissance is limited to areas within, adjacent to or near the project area where proposed ground disturbing activities may affect sensitive plant species. The area of potential habitat for sensitive plants within the South Deep project area includes: streams, wetlands, hardwood stands, forests, meadows and rocky outcroppings.

Intuitive-controlled sensitive plant surveys or revisits to known sites were conducted for this project from 1998 to 2003. The intuitive method first involves walking through the project area and the perimeter of the potential habitat. Next, the surveyor conducts a complete examination of specific areas of the project or walks more than once through the area.

Surveys of the project area resulted in the documentation of 17 new populations of the seven known sensitive species and four additional sensitive plant species in six populations*: Carex saxatilis var. major, Ophioglossum pusillum*, *Sisyrinchium septentrionale* and *Viola renifolia.* A total of 11 sensitive plant species in 36 populations are known from the project area. Shown below are the sensitive plants by habitat and the number of populations in the project area, as well as the number of populations on the Colville National Forest.

Surveys of the Project area resulted in the documentation of 29 new populations of sensitive plant species, including five additional ones: *Antennaria parvifolia, Carex saxatilis var. major, Ophioglossum pusillum*, *Sisyrinchium septentrionale,* and *Viola renifolia.* A total of 12 sensitive plant species in 43 populations are known from the Project area. Shown in Table 3-8 are the sensitive plants by habitat with the number of populations in the project area and on the Colville National Forest.

**Table 3-8. Sensitive Plant Populations by Habitat**.

| | **Number of Populations in the Project Area** | **Number of Populations on the Forest** |
|---|---|---|
| **Forested Species** | | |
| Botrychium crenulatum | 13 | 81 |
| Viola renifolia | 2 | 22 |
| | | |
| **Moist meadow species** | | |
| Antennaria parvifolia | 2 | |
| Botrychium hesperium | 5 | 13 |
| Botrychium paradoxum | 1 | 10 |
| Botrychium pedunculosum | 4 | 21 |
| Ophioglossum pusillum | 2 | 3 |
| Sisyrinchium septentrionale | 1 | 15 |
| | | |
| **Wetland species** | | |
| Carex flava | 6 | 27 |
| Carex saxatilis var. major | 2 | 2 |
| Cicuta bulbifera | 2 | 11 |
| Geum rivale | 3 | 16 |

# 3.2.3 Competing and Unwanted Vegetation: Affected Environment

"Native species are often valued more highly than exotic species because they represent the unique biological heritage of a region. Often, native species have co-evolved or developed close mutualistic relationships with one another, so that the loss of one may result in the loss of other species dependent on it.

Exotic species are generally considered to be a problem: when they interfere with human activities; when they change ecosystem function in negative ways; and when they cause the extinction or reduce the abundance of valued native species.

For ecosystem management purposes, dealing with exotics according to their relative threat or value, and striving to maintain or restore the native species of the area, is a more rational approach than trying to achieve a certain number of species or to eliminate all non-native species."[25]

## Noxious Weeds

A weed is a plant growing where it is not desired or any plant that is a nuisance, a hazard, or causes injury to humans, animals, or desired plants. Noxious weeds are defined by law as being non-native, undesirable, or difficult to control. They are species that have been introduced into North America from European, Asian, and Mediterranean countries. These species have little or no natural competition or controlling agents on this continent and are often considered weeds in their native environments because of their invading, pioneering, or aggressive characteristics.

Areas with soil disturbance or vegetation loss are the most susceptible to noxious weeds and repeated soil disturbance or loss increases susceptibility. Changes in vegetation type or site health also make sites more susceptible to noxious weeds. Most noxious weed species prefer open, hot, dry, or well-drained sites; however, there are noxious weed species within the analysis area that are adapted to moist sites. Cool-moist and closed canopy sites are most resilient to noxious weeds. Sites with an open canopy and either hot to dry or very moist conditions are most susceptible.

The equipment, animals and humans that expose bare soil and thus create habitat for noxious weeds are also vectors for noxious weeds. Vehicles and equipment move seed, including those not directly involved in soil disturbances or loses of vegetation. Seed is transported by snagging vegetation with seed heads or in dirt found on the frame, undercarriage, grill, or internally on vehicles and equipment. This may happen with non-motorized as well as motorized vehicles and equipment used on or off designated roads. Hay and feedstuffs used for livestock may contain noxious weed seed. Livestock that have been on infested pasture or have eaten contaminated hay or feed stuffs within a few days before entering or moving within the analysis area may pass seed through their manure. Humans may carry barbed seeds in their gear, clothing, or shoes. Recreationists import seeds on tents, all terrain vehicles, and other equipment from other areas. The use of seed that is not free of noxious weed seed for construction or restoration projects is another contributor to the introduction of noxious weed seed, as is the dumping of refuse or yard trash.

In addition to the natural movement of seed and plant material by wind and animals, there are many other mechanisms for movement. These include trapping, homesteading, haying of meadows, road and trail construction, mining, gravel pits, timber harvest and regeneration, prescribed and other man-caused fires, fire protection, a variety of recreation activities, livestock grazing, pasture improvement, and soil cultivation.

[25] Excerpted from "Ecological Steward21 A common reference for ecosystem Management, 1999 Elsvier Science Ltd.

Noxious weeds in the area that are considered A and B Class include diffuse and spotted knapweeds, Dalmatian toadflax, yellow hawkweeds, plumless thistle, and tansy ragwort, There are other noxious weeds present but they are designated C class weeds and generally are not of concern, examples would include mullein, bull thistle, St. Johnswort, and Canada thistle. Plumless thistle and the hawkweeds have the greatest impact on this area and have been the main target weeds for this area since the early 1990s using all methods of control. Since these weeds are so aggressive they will remain a concern for years to come and will be a target of continued control efforts.

# Management Direction and Guidelines

The noxious weed management strategy for the South Deep Project uses the *Region 6 Preventing and Managing Invasive Plants Forest Plan Amendment,* the *Environmental Assessment for Integrated Weed Treatment*[26] and the *Colville National Forest Weed Prevention Guidelines* in its design and is consistent with this direction.

The noxious weed management strategy focuses on the prevention of noxious weeds by using weed-prevention tactics and mitigation for all ground disturbing activities. These are designed to keep noxious weed seed from entering the area, to reduce soil disturbance and to revegetate disturbed sites. The South Deep noxious weed management strategy also prescribes early treatment of existing noxious weed populations by various methods. Other early treatment methods and long-term management of noxious weeds is covered in the *Environmental Assessment for Integrated Weed Treatment.*

The following table (Table 3-9) displays noxious weed species, abundance, and class within the planning area.

[26] The Forest Supervisor signed the decision notice for the Forest-wide "Integrated Noxious Weed Treatment" in 1998.

**Table 3-9. Noxious Weeds**

| Common Name | Scientific Name | Status on NFS lands within Project Area | Acres | Noxious Weed list status |
|---|---|---|---|---|
| Plumeless thistle | *Carduus acanthoides* | Invader | 19.7 | B designate |
| Diffuse knapweed | *Centaurea diffusa* | Established on dry openings; Invader in new openings and disturbances | 63.5 | B designate |
| Spotted knapweed | *Centaurea maculosa* | Potential Invader | 3.2 | B designate |
| Oxeye daisy | *Chrysamthemum leucanthemum* | Established in some homestead openings | 7.8 | B non-designate |
| Canada thistle | *Cirsium arvense* | Invader | 0.3 | C |
| Bull thistle | *Cirsium vulgare* | Invader on new disturbances | Present/unknown | C |
| Hounds tongue | *Cynoglossum officinale* | Potential Invader | Present/unknown | B non-designate |
| Yellow hawkweed | *Hieracium pratense* | Invader, becoming established in dry meadows and along roads | 326.7 | B designate |
| Goatweed (St. Johnswort) | *Hypericum perforatum* | Invader, becoming established in dry openings such as powerlines and rock outcrops | Present/unknown | C |
| Dalmatian toadflax | *Linaria genistifolia* | Invader | Present/unknown | B non-designate |
| Tansy Ragwort | *Senecio jacobaea* | Invader | Present/2 sites | A |
| Common tansy | *Tanecetum vulgare* | Invader | Present/unknown | C |
| Common mullein | *Verbascum thapsus* | Invader on newly disturbed or poor condition sites | Present/unknown | C |

The terms Potential Invader, Invader, and Established, used under **Status on National Forest System lands within Project Area** (Appendix B of the Weed Treatment Environmental Assessment) are used here to describe the listed noxious weeds in relationship to National Forest System lands within the South Deep Management Project area only.

## Cumulative Effects of Past Activities

Noxious weeds did not occupy the South Deep Analysis Area until the in-migration of Europeans and others. The current condition however, is the result of a century of activity in the analysis area. Many species arrived on the North American continent with settlement by Europeans. Mode of arrival included contaminated grain and seed, ship ballast, livestock hay or feed, and sheep wool, attached or not. Some weeds arrived intentionally for ornamental or landscaping uses. These introduced species then invaded the continent in a "reverse watershed" pattern, generally following the waterways from the coast to the headwaters, following settlement patterns. Improved methods of travel, including the railroads and steamboats, promoted this spread.

Almost all human activities have concentrated along the transportation systems (roads and trails), meadows, and creeks within the watershed. Many of the current transportation routes lie along the same routes, as did historical ways, trails, and roads. In recent decades, expansion of these routes and additions of new routes have occurred. It is not a coincidence that noxious weeds have expanded the same way. Human activities have increased the extent of noxious weed species and populations.

# 3.2.4 Threatened and Endangered Wildlife Species: Affected Environment

Under Section 7 of the Endangered Species Act of 1973, as amended; federal agencies are required to "ensure" that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of Threatened or Endangered species or result in the destruction or adverse modification of their critical habitats. The Forest Service has established direction for Threatened or Endangered species and habitat management, which identifies the process, objectives, and standards for conducting a "Biological Assessment". The four-step process for conducting the Biological Evaluation follows:

1. Prefield Review of existing information
2. Field Reconnaissance of the project area
3. Risk Assessment if species or habitat is present
4. A Biological Investigation may be required if insufficient data exist to complete step 3.

After completing any one of the first two steps, a determination may be made that a project would have no effect on a Threatened or Endangered species or its habitat. The following is a summary of the risk assessment for Threatened or Endangered birds, mammals and fish in South Deep Watershed. Species discussions follow.

**Table 3-10. Steps 1, 2 and 3 of Risk Assessment**

| SPECIES | Step #1 PRE-FIELD REVIEW | Step #2 FIELD RECONNAISSANCE | Step #3 RISK ASSESSMENT | |
|---|---|---|---|---|
| Bald eagle (T[a]) | Habitat present | Species present | Alt. A (No Action)<br>Action Alts. E and G | No Effect<br>NLTAA[b] |
| Grizzly bear (T) | Habitat present | Species may be present | Alt. A (No Action)<br>Action Alts. E and G | No Effect<br>NLTAA |
| Woodland caribou (E) | Habitat present | Species not found | Alt. A (No Action)<br>Action Alts E and G | No Effect<br>No Effect |
| Gray wolf (E) | Habitat present | Species may be present | Alt. A (No Action)<br>Action Alts. E and G | No Effect<br>NLTAA |
| Canada lynx (T) | Habitat present | Species present | Alt. A (No Action)<br>Action Alts. E and G | NLTAA<br>NLTAA |
| Bull trout (T) | Habitat present | Species not present | Alt. A (No Action)<br>Action Alts. E and G | No Effect<br>No Effect |

[a] T=Threatened, E=Endangered, P = Proposed

[b] Not Likely to Adversely Affect

# Bald eagle (*Haliaeetus leucocephalus*): Affected Environment

The Pacific States Bald Eagle Recovery Plan (USFWS 1986) provides management direction for bald eagles on the Colville National Forest. Bald eagle habitat on the Colville National Forest consists of nest sites and winter roost sites, and some foraging habitat (large bodies of water that contain fish).

## *Nest Sites*

Adult bald eagles frequent Big Meadow Lake but none has nested. The available supply of fish in Big Meadow Lake and the large trees nearby provide good habitat for bald eagles. There are no streams in the watershed large enough for foraging by bald eagles.

In the past decade, bald eagles have established several new nests within Stevens County, and the bald eagle population continues to expand. The nearest known nests are along the Columbia River about 8 miles northeast of the watershed.

## *Roost Sites*

The South Deep watershed does contain forest stands with the large tree component required for winter roost sites however these areas are not considered as potential roost sites for concentrations of wintering birds because these areas lie too far from the Columbia River. National Forest System land within the South Deep watershed begins about 8 miles from the Columbia River. The closest winter concentration of bald eagles is over 30 miles southwest of the planning area's southern boundary.

# Grizzly bear (*Ursus arctos*): Affected Environment

The Colville National Forest Land and Resource Management Plan (Forest Plan) standard and guidelines, appendix H of the Forest Plan Final Environmental Impact Statement, the Interagency Grizzly Bear Guidelines (IGBC 1986), and the Grizzly Bear Recovery Plan (USFWS 1982b, updated 1993) contain management direction for the Colville National Forest (documents on file at the Colville National Forest Supervisor's Office). The Grizzly Bear Recovery Plan (USFWS 1993a) identifies "grizzly bear ecosystems" which contain specific recovery areas. The recovery

plan classifies areas by "Management Situations" based on the needs of the bears and the capabilities of the areas to supply those needs. The South Deep watershed lies within a Management Situation #5 which is not managed primarily as grizzly bear habitat. Components of grizzly bear habitat that we analyze include travel corridors and hiding cover, forage, and densities of motorized routes (roads and motorized trails passable with OHVs and 4-wheeled drives), which provides a measure of core area or secluded habitat.

Transient grizzly bears might infrequently occupy the watershed. The Natural Heritage Program Database lists two verified grizzly sightings near the watershed in the 1990s. One bear was video-taped about 3 miles west of the watershed in 1995, and another was shot in 1995 about 2 miles south of the watershed. Unverified reports in other years have come from the general area where the bear was videotaped, just west of the watershed.

# Woodland caribou (*Rangifer tarandus*): Affected Environment

The woodland caribou is being managed under a recovery plan approved by the U.S. Fish and Wildlife Service in 1993 (USFWS 1993b). The only recovery area identified in the State of Washington is east of the Pend Oreille River in the northeast corner of the Selkirk Ecosystem. At present, woodland caribou within the Selkirk Ecosystem exist only in the extreme northeastern corner of the state, separated from the watershed by the Pend Oreille River and the east side of the mountains between the watershed and the river.

# Gray wolf (*Canis lupus*): Affected Environment

The Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987) identifies three areas for wolf recovery: Yellowstone, northwest Montana, and central Idaho; Washington State does not contain any wolf recovery areas. Any wolves found outside recovery areas receive federal protection, though the areas they inhabit are not managed to provide wolf habitat. The Forest Plan calls for wolf monitoring by recording location and determining validity of reported sightings.

Components of wolf habitat listed in the Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987) include the ungulate prey base, suitable and somewhat secluded denning and rendezvous sites, and sufficient space with minimal exposure to humans (core area habitat).

Records of wolf sightings on the Colville National Forest date from 1914 (Hansen 1986). Confirmed and unconfirmed sightings have occurred since, including confirmed sightings in the 1990s north and east of the area. No confirmed sightings have come from the watershed. We conducted howling surveys within the watershed in the early 1990s but no wolves responded. Wolf packs have not been located on the Three Rivers Ranger District, but single animals probably move through the watershed.

# Canada lynx (*Lynx canadensis*): Affected Environment

## *Analysis Elements*

In February, 2000, the USFWS and USFS signed the Lynx Conservation Agreement to formalize the two agencies' agreement to utilize Lynx Science Team Report (Ecology and Conservation of Lynx in the United States (Ruggiero et al. 1999)) and The Lynx Conservation Assessment and Strategy (Ruediger et al. 2000)) to plan and analyze projects to ensure a comprehensive approach to conserving lynx. The Forest Service conducted this analysis using analysis elements

identified in the Lynx Conservation Assessment and Strategy because that document contains the best available science relating to lynx management.

It remains difficult to discretely categorize stands as anything but unsuitable habitat or a form of forage habitat because foraging habitat contains a wide variety of stand conditions, from very good forage habitat that supports many snowshoe hares to poor forage habitat that supports few snowshoe hares or alternative prey. Denning habitat also supports snowshoe hare and alternate prey and thus can be considered a subset of forage habitat.

Though not a creature limited to roadless areas or wilderness, lynx might be affected by human access into their habitat, especially during winter or the denning season. The extent and magnitude of disturbance that would affect lynx is not known, but preliminary information suggests that lynx do not avoid the types of roads or disturbance levels that occur in the project area (Ch. 12 in Ruggiero et al. 1999). Though lynx might not avoid them, roads can still negatively affect lynx by allowing human disturbance in denning habitat and increasing access for incidental or illegal hunting or trapping. Plowing or packing snow on roads or snowmobile trails in winter might allow competing carnivores to access lynx habitat thus increase competition for prey. Roads also create disturbed soil that noxious weeds follow to non-infested areas and reduce forage for snowshoe hare.

The Lynx Conservation Assessment and Strategy suggests that management actions not change more than 15% of lynx habitat within a lynx analysis unit to an unsuitable condition within a 10-year period, and that no more than 30% of a lynx analysis unit should be in unsuitable condition.

Lynx Conservation Assessment and Strategy information only applies to Federal land. However, effects to non-federal land that supports potential lynx habitat are included because the activities on private lands might affect management activities on Federal land.

## *Affected Environment*

### Denning Habitat

Over the range of the lynx, the common component of denning habitat is large woody debris, either down logs or root wads (Hoving 2001, Ch 11 in Ruggiero et al. 1999; Koehler 1990; G. Mowat pers. comm.; B. Slough pers. comm.; J. Squires pers. comm.). Managing lynx denning habitat on the Colville National Forest involves providing high densities of down logs or larger-diameter stands on mesic, cooler sites.

Based on ground surveys of National Forest System land, about 11% (600 acres) of the lynx analysis units contain an overstory of the type that lynx denned in on the Okanogan National Forest (Koehler 1990) and in Montana (J. Squires, pers. comm.). A few small areas of wind-throw were noted in the lynx analysis unit during field reconnaissance, and some of this down wood would contribute to denning habitat. No non- National Forest System land contains denning habitat.

### Habitat Distribution

The Huckleberry lynx analysis unit lies in a group of lynx analysis units that starts at the Canadian border and continues south to just past 49-Degrees North ski resort, and covers about 270 square miles. Few of these lynx analysis units have been completely surveyed, and the estimated amount of lynx habitat within these lynx analysis units probably is significantly less than the lynx analysis unit size.

### Connectivity Areas (corridor routes)

No travel corridors in the lynx analysis unit have been eliminated due to past harvest. Ridges form the southern and eastern boundary of the watershed and lynx analysis unit. In these areas, old harvest units lie on and near the ridge tops, though sufficient cover remains for animals to move through the area. Cover on the single large interior ridge is adequate.

### Forage Habitat

In the watershed, no large fires occurred within the past 30 years to regenerate lodgepole pine stands, thus expanses of young, high-quality forage do not exist. Almost no part of the lynx analysis unit contains dense, young even-aged forests. Much of the habitat consists of middle structural-stage stands with dense undergrowth that provide rather poor forage habitat for snowshoe hares. About 380 acres of past harvest currently provide good forage habitat, and about 700 acres of past harvest that currently does not support much cover should grow into good foraging habitat in the next 5 to 15 years.

Most of the forage consists of mature forests with somewhat dense ground cover and down wood that provides habitat for hares (at lower densities than in young stands) and red squirrels. These habitats vary less over time than younger stands and sustain a more stable though lower population of prey than younger forests. About 3,690 acres of lynx habitat (and nearly all the non-National Forest System land) in the Lynx Analysis Unit fits this description.

## Bull Trout (*Salvelinus confluentis*): Affected Environment

On July 10, 1998, the U.S. Fish and Wildlife Service determined the status of the Klamath and Columbia River distinct population segments of bull trout as threatened. The Colville National Forest falls within the geographic area comprising the Columbia River population segment. Section 7 of the Endangered Species Act of 1973, as amended, requires federal agencies to "ensure" that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of Endangered, Threatened, or Proposed species, or result in the destruction or adverse modification of their critical habitats. Since potential impacts of proposed projects to aquatic ecosystems often extend downstream beyond project boundaries, evaluations are being completed on a watershed scale, at the 5$^{th}$ or 6$^{th}$ field watershed level.

There are presently eight 6$^{th}$ field watersheds on the Colville National Forest known to be occupied/used by bull trout. There are an additional 60 fish-bearing 6$^{th}$ field watersheds all or partially within Colville National Forest boundaries that are not presently known to be occupied by bull trout. Twenty-five of these watersheds have no historical or presently known bull trout populations and also contain significant natural blockages to fish passage (at the 6$^{th}$ field watershed level) which have been determined to effectively isolate them from other known current and/or historical bull trout habitats.

Several 5$^{th}$ field watersheds (containing 6$^{th}$ field watersheds) tributary to the 4$^{th}$ field Columbia River (Lake Roosevelt) and Colville River watersheds fall within this group that have no historical or present occupation by bull trout. These 5$^{th}$ field watersheds include Deep Creek which is a tributary to the Columbia River (Lake Roosevelt).

All of the subwatersheds within the South Deep analysis area drain into the Deep Creek watershed (Meadow, Rocky, Kolle, Scott, Kenny, Miller, Little Smackout, Clinton, Rabbit and Rogers creeks). These watersheds have been electrofished for fish presence during a period from 1992 to 2000. No bull trout have been found. There is no historical documentation of bull trout in the Deep Creek watershed. There is a natural blockage to fish passage that exists in the form of vertical falls approximately 3 miles from the mouth of Deep Creek.

# 3.2.5 Forest Service Sensitive Species

The Forest Service established direction (Forest Service Manual 2670) to guide habitat management for endangered, threatened, proposed and sensitive species to ensure that these species receive full consideration in the decision-making process. That direction establishes the process, objectives, and standards for conducting a Biological Evaluation.

The R-6 supplement to Forest Service Manual 2672.4 identifies a four-step procedure for conducting the Biological Evaluation. The steps are:

1. Pre-field review of existing information
2. Field reconnaissance of the project area
3. Risk assessment if species or habitat is present
4. Biological investigation if data sufficient to complete step #3 do not exist.

The Biological Evaluation analyzes the effects of the proposed project on US Forest Service sensitive species most recent Regional Forester's Lists of Sensitive Species for Region 6 dated July 21, 2004 for animals and plants that potentially occupy the project planning area.

## Common Loon (*Gavia immer*): Affected Environment

The Forest Plan provides no specific Standards and Guidelines or management direction applicable to this species. Common loons breed on larger lakes (generally, at least 50 acres in size) with abundant fish and secluded nest sites. Loons nest at the water's edge, on land or floating mats of vegetation. Loons are susceptible to disturbance during the breeding season. In autumn, they migrate to wintering areas along the coast or on large inland lakes that do not freeze. Elements considered limiting factors to successful loon nesting in Washington include: shoreline development, fluctuating water levels, and human disturbance

The Washington Department of Fish and Wildlife reports a total of 20 confirmed common loon nest sites known to be active for at least one year during the years 1979-1999 (Richardson et al. 2000). In Washington, the annual number of nests during 1990-1999 ranged from 8 to 10.

Loons are more frequently sighted in the vicinity of the Colville National Forest than in the 1990s, especially during the breeding season. Pairs have nested on lakes on the east and west side of the forest.

Loons have been reported from Big Meadow Lake the past several years, though none has yet nested. Though the lake covers about 80 acres, much of that is too shallow for use by loons and the lake is considered marginal from the standpoint of nesting habitat. It is expected that the lake will continue to be used as foraging habitat.

## Wolverine (*Gulo gulo*): Affected Environment

The Forest Plan provides no specific Standards and Guidelines or management direction applicable to this species. Wolverines are rare in northeast Washington, but may be found throughout the Colville National Forest. Wolverines are most often associated with boreal woodlands, but may be found in almost any habitat type. Research indicates wolverine habitat use is based more on adequate year-round food supplies and large, sparsely inhabited wilderness areas than on particular topography or plant associations.

The wolverine is a solitary, highly mobile animal requiring large territories. Territory size and seasonal movements of wolverines are influenced by food availability, breeding activity, and habitat conditions, including availability of denning sites and seclusion. Wolverines are

considered opportunistic scavengers, consuming a wide variety of plant and animal food, with carrion (especially big game animals) serving as the mainstay of the animal's winter diet. Surplus food is often cached for later use. Remote country with limited human activity appears essential to maintenance of viable wolverine populations. Radio-tracking studies indicate wolverines would separate themselves from human activities if areas with less human disturbance were available.

Because of the occurrence of sightings, the wolverine's large territorial requirements, and the presence of secluded, forested habitat, the South Deep Planning Area provides suitable wolverine habitat.

The agricultural land in the valley of the South Fork of Deep Creek nearly bisects the watershed and poses the greatest challenge to wolverine movements. The maximum opening a wolverine would have to traverse in order to cross the valley is about 0.5 miles. Most openings are less than 0.25 miles across, and a few areas have contiguous cover. The agricultural land would not prevent wolverine from crossing the valley.

Aside from the ridges that form the boundary of the watershed, two main ridges exist in the watershed. One lies between Rocky and Meadow creeks and contains Seldom Seen and Aladdin mountains. The other, a lower-elevation, less-defined ridge, runs northeast from Ione Hill. Past harvest on the first ridge does not affect much area. Past harvest on the second ridge affects only the eastern part, where units from the Divine timber sale in the early 1990s reduce the width of but do not eliminate the corridor. Animals probably would not pass through the large natural openings on the south and southeast side of Aladdin Mountain and on the south and southeast sides of Ione Hill but would use the more forested areas around the openings. About 11 units from past harvest along the boundaries of the watershed have affected the corridors along those ridgelines, but all are surrounded by forested areas and would not prevent wolverines from moving through the corridor.

### Prey

The South Deep watershed contains summer and winter range for big game, thus provides prey for wolverines the entire year. We examined current conditions within the National Forest System lands in the area and cumulatively on all lands within the watershed. White-tailed deer are more common than mule deer; white-tailed deer have increased in abundance and mule deer have decreased. Elk numbers are fairly stable to increasing slightly, and moose numbers are increasing.

### Winter and Summer Range

About 8% of the National Forest System land in the watershed (3,777 acres of MA6 and MA8) was designated as big game winter range during development of the Forest Plan.

The entire watershed can be considered summer range. Sites with cooler microclimates and areas near water are important components of summer range. Some areas in the southern half of the watershed have unroaded characteristics, but large unroaded areas do not exist in the planning area. Several roads in the planning area follow riparian areas, and thus affect higher-quality summer range.

### Core Area/Seclusion Habitat

Seclusion habitat does not remain in large blocks but is scattered, with the largest piece being a 1.4 square mile area west of the Aladdin Road. The Mount Rogers/Rogers Mountain area contains about .75 square miles of seclusion habitat, but connects with another block of seclusion habitat just west of the watershed. Other blocks of seclusion habitat are less than 0.5 square miles in size. These blocks are less than 0.5 miles across and probably do not function as seclusion habitat. Considering the home range size of wolverine, the amount of seclusion habitat remaining is not significant. The wolverine that was seen in the watershed was not in seclusion habitat.

### Denning Areas

The watershed does not contain high mountain cirques or talus slopes that wolverine use for denning.

## Townsend's Big-eared Bat (*Coyrnorhinus townsendii*): Affected Environment

The Colville Forest Plan does not contain specific standards and guidelines or management direction pertaining to Townsend's (also called Western) big-eared bats. Townsend's big-eared bats may occupy almost any type of habitat, from grasslands to mixed conifer forest. This bat typically roosts and hibernates in caves or mine adits (almost horizontal entrances to a mine), or shafts.

Bat surveys were conducted at some adits, vertical shafts, and buildings in 1988/89 (Perkins, 1989 and Perkins 1990). These areas were surveyed November 1-16 to find winter hibernacula. Perkins reports that summer surveys occurred at the same sites. No nursery sites were found. Perkins documented three Townsend's big-eared bat hibernacula locations on or near National Forest System lands on the Three Rivers Ranger District (east). Ormsbee (2002) indicates that, depending on weather conditions, November surveys may not be late enough to actually determine hibernacula use. Although the unpublished document defines winter to be from November 1 through mid-April, it states that the peak use is in January or February. The most productive winter hibernacula surveys are from January 1 through February 30 (Ormsbee et al. 1998, unpublished). Perkins' two Forest Service locations where these bats are documented are all in the northern half of Three Rivers east. Those two Forest Service locations are within the South Deep planning area boundary. Perkins observed two bats at one site and one bat at the other in the winter of 1988. Perkins' third 1988 Townsend's big-eared bat documented location is north of this planning area, on BLM administered lands. Six bats were observed at this site. No bats were found at the BLM adit when he resurveyed in this location in 1995. Additional surveys would be necessary to conclude that Townsend's big-eared bats may no longer occur at any historical location.

Forest Service biologists confirmed the presence of one Townsend's big-eared bat at one adit in South Deep on October 3, 2000. Forest Service personnel revisited these locations on August 5, 2002 to map accurate locations of these sites using GPS technology.

The other Forest Service Townsend's big-eared bat location documented by Perkins has not been resurveyed since 1988. It is considered a "closed" claim. Forest Service personnel revisited this site on August 7, 2002 to obtain an accurate location.

District biologists found a new Townsend's big-eared bat roost location (one bat) in 1993 (9/24/93). This site is on National Forest System lands and is north of the South Deep Planning area. A single Townsend's big-eared bat was also mist netted by Eastern Washington University researchers at this fourth site in 1995 (7/20/95). This site was not surveyed in winter. This claim remains "active".

Perkins conducted another bat survey on the east half of Three Rivers Ranger District (former Colville District) in 1995 because mining activities were proposed at the site found in 1993. This was, in part, to determine whether a maternity roost might be present at that site. During the survey period, he also revisited several of the sites he had surveyed in 1988, but did not search any of the areas within the South Deep planning area that he had surveyed in 1988. Perkin's 1995 report suggests that some of those sites appear to have adequate habitat for hibernacula, day roosts and night roosts and that he was perplexed that he did not observe any bats. Multiple surveys would be necessary to conclude that bats are not using any of these sites.

Reproductive use on the eastern portion of Three Rivers Ranger District has not been observed, but there is a maternity site on the adjacent Sullivan Lake Ranger District. Ormsbee (2002) notes that this is probably close enough that all these bats can interact. Perkins (1995) refers to

Pierson et al. 1991 stating that most maternity roosts in California are at least 30 m in length. Some of the known adits in South Deep planning area are this size. National Forest System lands and other ownerships within South Deep planning area also have old buildings, bridges and other adits that may provide other potential hibernation, day or night roosts, or reproductive habitat.

Townsend's big-eared bats are highly sensitive to disturbance. They have a high degree of site attachment and fidelity (University of New Mexico's Sevilleta LTER 2002). Because Townsend's big-eared bats are "sedentary and extremely selective about their roosts, roost loss can be serious" (Pierson 1988). The Idaho State Conservation Effort (1995) indicated that this species has low reproductive potential and high longevity as well as high roost fidelity, so populations are highly sensitive to roost threats. Loss and/or disturbance of suitable roosting habitat are probably the primary factor leading to population declines. Perkins (1990) states: "The scattered P. townsendii noted on the Colville National Forest likely indicates high disturbance at hibernacula, and a probable downward trend in population numbers." Townsend's big-eared bats do not shelter in crevices and they often roost in the twilight zone close to the entrance (Pierson 1991), so are highly visible thus more vulnerable to disturbance even from casual visits.

Surveys were not conducted on all adits in South Deep to determine presence/absence, species, and season of use. Surveys of the intensity necessary to detect season of use and species are not recommended due to the time and budget constraints and the possibility of not detecting use.

# Fisher (*Martes pennanti pacifica*): Affected Environment

The Colville National Forest Plan does not contain specific standards and guidelines or management direction pertaining to the fisher. Fishers are solitary animals. Fishers prefer mature to old growth coniferous forests containing a diversity of habitat types and successional stages. The best habitats are multi-aged stands interspersed with openings and containing riparian habitats (Banci 1989). Fishers prefer forested riparian areas for foraging, resting, and travel corridors (Heinemeyer and Jones 1994). They prefer mature to old growth grand fir forests and utilize stands containing pacific yew with large diameter spruce and Douglas-fir particularly in the summer (Jones 1991). During the winter, fisher prefer "decadent-seral stands" of lodgepole pine consisting of larger diameter live and dead trees and logs and a pacific yew understory component. They avoid openings regardless of season. Home ranges vary between 0.61 and 15 square miles.

The fisher is a generalist predator, feeding on a variety of small to medium-sized birds, mammals, and carrion. Habitat that offers cover (50-90%) for fisher and their prey is critical during the winter (Washington Department of Wildlife 1991). Fisher uses riparian areas, ridgelines, and lakeshores in and adjacent forest cover for foraging areas and movement. Fishers prefer to hunt in habitat consisting of >40% canopy cover, such as old growth, mature, pole, and sapling forests, and avoid non-forest habitats (Jones 1991). During the summer months, fishers prefer a continuous canopy closure of mature and old growth habitat along with riparian habitat for foraging and denning. During the winter, fishers utilize young and mature forests.

Availability of cover dictates resting and denning sites. The fisher requires a large component of dead and down materials for resting and denning sites. Fishers utilize primarily hollow logs, snags, live tree canopies, mistletoe bundles, and brush piles as resting sites (Jones 1991). Denning sites are located in cavities high in live or dead trees (Powell and Zielinski 1994).

Threats to fishers include hunting and trapping, and the loss and fragmentation of late successional forest by timber harvest activities. However, fisher adapt better to early successional forests, than do pine marten (another animal inhabiting similar habitat), as long as there is adequate cover. Loss of preferred habitats and habitat connectivity reduces the availability of resting, foraging, and denning sites. Analysis indicators include the amount of late structure mature forest, old growth stands, and maintenance of suitable snag and availability of downed woody materials. Forest tracts of 245 acres or more, interconnected with other large

areas of suitable habitat, including a dense understory of young conifers, shrubs and herbaceous cover for summer use, are important. Threats include fragmentation (NaturesServe 2000).

Fisher populations are extremely low in Washington State (NatureServe 2000) and could become completely extirpated (Lewis and Stinson 1998). No specific surveys have occurred on Three Rivers (east), though reports of fisher sightings are recorded. The Washington Department of Fish and Wildlife confirms one dead fisher in the Calispell Peak area, approximately 15 miles from the South Deep planning area. This 1994 sighting was a mortality of a fisher that had been released into Montana. The database lists other fisher occurrences in eastern Washington in the last 30 years (and a scattering of older reports), but all are farther from the planning area. These sightings have a variety of reliability ratings. There are no other reports of fishers in Stevens County in the Washington Department of Fish and Wildlife database. There is no documented evidence of fishers inhabiting South Deep planning area. The South Deep planning area may provide at least some of the diverse habitat components fishers use, therefore, it is possible that fishers may use the analysis area. Based on a low likelihood of success, surveys are not planned in the South Deep project area.

# Great Gray Owl (*Strix nebulosa*): Affected Environment

The Forest Plan does not contain specific standards and guidelines or management direction pertaining to great gray owls. Nesting habitat, including a platform for nests proximity to good foraging, is probably the most important habitat component for this species. The vast majority of prey species are small rodents (Johnsgard 1988). Great gray owls may nest in many types of forest habitat. These can be moist to dry and can be all coniferous, all deciduous or a mix of both. Western United States conifer types can include Douglas-fir, grand fir, lodgepole pine, Ponderosa pine, western larch, Englemann spruce, or combinations. The Forest Service General Technical Report RM-253 Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment (Haywood and Verner 1994) reports nesting habitat from several studies. In British Columbia, Douglas-fir with patches of aspen was reported as the type most often used. In southeastern Idaho and northwestern Wyoming, most of the nest sites were in the lodgepole pine/Douglas-fir/aspen zone. In northeastern Oregon, all forest types sampled had nests, but nests were most common in Douglas-fir/grand fir, followed by lodgepole pine/western larch, then ponderosa pine/Douglas-fir, and least in ponderosa pine. In central Oregon, meadow systems associated with coniferous forests were used. Other forest types were reported in RM-253, but these were the areas nearest Washington. The nests reported in southeastern Idaho and northwestern Wyoming were found in mid-to late-successional forests. Relatively high canopy closure was reported at most nest sites in one Oregon study. Most often, nesting habitat was associated with proximity to good foraging opportunities—openings such as meadows, pastures, marshes, lakes, and young clear-cuts or in open forests. Nests have been reported in broken-top snags, in old corvid or raptor (often goshawk) nests, on platforms formed by dwarf-mistletoe, on artificial platforms and on other sites. Nest proximity to forage may be more important than nest structure or support. Gail Worden (personal communication) related that on the Targhee National Forest they found nests very near openings (within a few hundred feet), including clear-cuts. Marshall (1992) quotes a study in northeastern Oregon: “we found Great Gray Owl nests in all forest types…, but the majority of nests were in over-mature or remnant stands of Douglas-fir and grand fir forest types on north-facing slopes”.

Another habitat feature that literature and personal communication suggest is important is the availability of structure that the young can use to escape predators. After leaving the nest, fledglings are vulnerable and need structure such as leaning trees to climb to perches off the ground and away from possible predators. Dense cover also helps protect young owls.

Johnsgard (1988) states “breeding almost certainly occurs in Washington, but its occurrence in that state is virtually undocumented”. No specific surveys have occurred on the Colville (east) portion of the District, though great gray owl sighting reports are recorded. Great gray owl observations have been reported only a few times on the entire Colville National Forest. One

report of a great gray owl sighting is from a location within the South Deep planning area. Wildlife personnel specifically surveyed for great gray owls in that location in response to the sighting report. No great gray owls were found. We have also surveyed within the South Deep analysis area many times over several years, including night surveys for wolves and barred owl surveys, but have never encountered this species here. No additional surveys specifically for great gray owls are planned in the South Deep analysis area.

# Peregrine falcon (*Falco peregrinus*): Affected Environment

Management for peregrine falcon on the Colville National Forest (Colville National Forest Land and Resource Management Plan 1988) directs the Forest Service to monitor nest sites for activity and to support recovery plan efforts. The Recovery Plan for Peregrine Falcon (USFWS 1982a) lists nesting habitat requirements as cliffs over 150 feet in height. A foraging area associated with the nesting territory usually includes wooded areas, grasslands, and marshes or open water. Though the US Fish and Wildlife Service de-listed the peregrine falcon in 1999, the same elements are still used to analyze habitat.

### Nesting Sites

The Joe cliffs are the only tall cliffs in the area, and these lie south of the South Deep watershed. Joel Pagel, peregrine specialist for Region 6 of the Forest Service, examined them and determined that they did not provide nesting habitat (Pagel 1993). No historical records list peregrine falcon as having nested on or near the Colville National Forest.

### Foraging Habitat

The agricultural areas along the highway provide some open foraging habitat. Little foraging habitat exists on National Forest System land.

# Interior Redband Trout (*Oncorhynchus mykiss gairdneri*): Affected Environment

Rainbow trout populations have been found throughout the western portion of the Colville National Forest. Genetic testing of many of these populations has determined that presently 13 pure redband trout populations exist on the forest. These populations are found in tributaries of the Kettle River, tributaries to Lake Roosevelt, tributaries to the Colville River and a tributary to Curlew Lake. Pure interior redband trout are not known within the analysis area. Other populations of hybrid coastal rainbow/interior redband trout or coastal rainbow/interior redband/westslope cutthroat trout have been found throughout the forest. Coastal rainbow and interior redband trout hybrids are present in Meadow Creek within the analysis area. The hybrid rainbow trout in Meadow Creek are reproducing based upon size range and numbers. The genetic identity of the rainbow trout in the South Fork of Deep Creek is presently unknown.

# Westslope cutthroat trout (*Oncorhynchus clarki*): Affected Environment

Westslope cutthroat populations have been found primarily on the eastern half of the Colville National Forest within tributaries of the Pend Oreille River, the Colville River and Deep Creek (a tributary to Lake Roosevelt). A few populations have also been found west of Lake Roosevelt in Pierre Creek, Deep Creek (a tributary to the Kettle River) and the South Fork of the San Poil

River. Westslope cutthroat trout are present in the analysis area in Rogers, Rocky and Byers creeks. The fish in Rogers and Byers creeks are very limited in distribution but appear to be reproducing based upon size range of observed individuals. The populations of Rogers and Rocky creeks have been genetically analyzed and found to be pure westslope cutthroat trout. The population in Byers Creek will be analyzed for purity in the future.

## Pygmy whitefish (*Prosopium coulteri*): Affected Environment

Pygmy whitefish populations have only been found within Sullivan and Bead lakes on the Colville National Forest. Neither lake is adjacent nor within the project area. The species and their habitat are not present in the project area.

# 3.2.6 Management Indicator Species

This document discusses the potential effects to Management Indicator Species listed in the Colville National Forest Land and Resource Management Plan that might be found within the South Deep Watershed Project Planning Area that do not have special threatened, endangered or sensitive status.

The Colville National Forest based the habitat capability objectives listed in the Forest Plan (page 4-13) on 1980 populations. Because the Forest Service manages habitat and the State of Washington manages wildlife populations, the Forest Service objective is to provide habitat capable of supporting the desired population of each management indicator species.

## Ungulates (Big Game): Affected Environment

South Deep watershed provides both summer and winter range for wild ungulates. Forest Plan winter range is displayed in Figure 3-10. This occurs only on lands managed by the Forest Service. The winter range is near the Aladdin Valley, on both sides of the Aladdin Highway (county road 9435). Other biological winter range does occur within the watershed, both on National Forest System lands and on other ownerships. The watershed is all considered summer range.

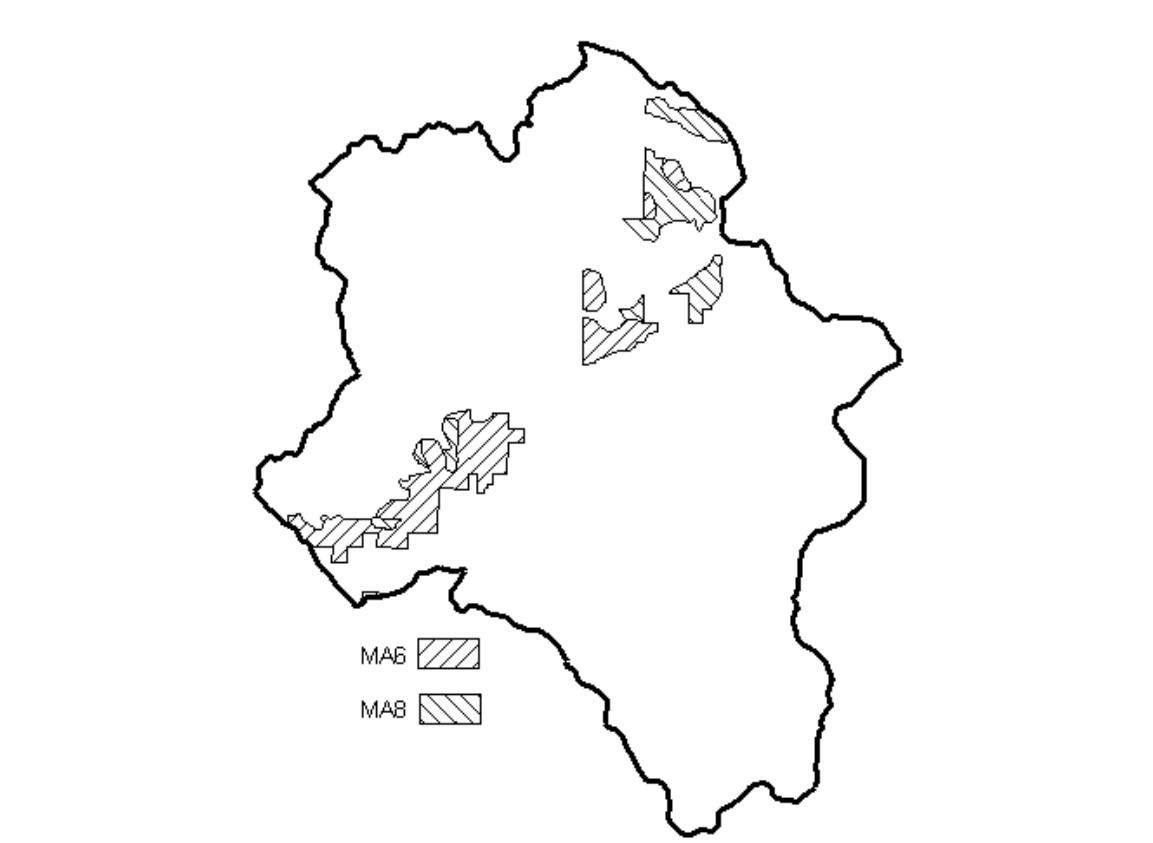



**Figure 3-10. Forest Plan Designated Winter Range in South Deep Watershed.**

# Pine Marten, Pileated Woodpecker, Barred Owl: Summary

The Forest Plan established management areas (MA-1) for many species that depend on “late” (or mature to older) type timber stand structure and conditions, using the barred owl as the indicator species for this habitat. The Plan also directed us to manage habitat for pileated woodpecker and pine marten in a grid layout that included the MA-1s. Pileated woodpecker management requirement areas are spaced about every 5 miles apart on National Forest System lands where an MA-1 does not occur. Each pileated woodpecker management requirement area consists of one block of habitat that is at least 300 acres in size. Between the MA-1s and pileated woodpecker management requirement areas, the grid pattern spaces pine marten management requirement areas at about every 2 to 2 ½ miles. For pine marten, each management requirement area consists of one to three rotations. Most marten management requirement areas were given three rotations during this temporary delineation.

Overall the South Deep watershed currently provides generally poor to adequate pine marten, pileated woodpecker, and barred owl habitat with some exceptions. Large fires over much of the area created many densely stocked stands with smaller diameter trees that are not developing into the larger tree, multi-stratum habitat preferred by marten. Also, there has been timber harvest in some of the areas that did have stands with larger trees, so that larger blocks of good habitat are difficult to find.

This project formally establishes pine marten “A” (current) management requirement areas and future marten management requirement area rotations (“B” and “C”) to provide habitat in the grid pattern required by the Forest Plan. Timber harvest would not occur in the current (A) rotations,

but often is proposed in subsequent rotations. Some other management activities may be proposed in the pine marten A management requirement areas. The project also formally establishes the pileated woodpecker management requirement areas. The two pileated woodpecker management requirement areas exclude commercial timber harvest, but other treatments may be proposed. In all action alternatives, some management requirement area delineations would change and others would remain as they were informally managed. The no action alternative continues the informal delineations. The project analyzes quality of the current MA-1 management areas to determine whether better habitat is available elsewhere. No changes are proposed to MA-1 boundaries through this project decision, so all alternatives continue the current management area delineations. However, any of the MA-1 areas that overlap into other watersheds may be reconsidered when those watersheds are analyzed. Commercial harvest would not occur within MA-1 boundaries, but other management activities may be proposed.

All or portions of eleven pine marten management requirement areas and two pileated woodpecker management requirement areas occur in the planning area. One barred owl habitat area (referred to as Hudson/Thomas MA-1) is completely within the South Deep Watershed. There are three MA-1 areas that are only partially within the boundary. These are referred to as the Rogers MA-1, the Meadow Lake MA-1, and the Smackout MA-1. The Forest Plan states that MA-1 "old growth management areas would be at least 600 acres in size" and further states that if this is managed as separate core and forage areas that core areas "would consist of old growth forest in a contiguous unit of 300 acres or more". Travel linkages (corridors) between the management requirement areas, MA-1s and structural stage 6 (SS6) stands are also considered in this section, because all biophysical environments that support marten habitat fall below the historic range of variability for late structural stage. Most harvest prescriptions for proposed units (outside of MA-1s and the current management requirement areas) are designed to move the stand towards late structural stage more rapidly than if selective harvest did not occur. Thus, over time, these areas should provide better alternate marten, pileated or barred owl habitat.

## *Pine Marten (Martes americana): Affected Environment*

The Forest Service selected marten as indicators of mature and old growth mesic coniferous forests with an abundant down log component. The habitat capability objective requires habitat of appropriate size, quality and distribution to maintain a viable population. Forest Plan standard and guideline 4-40 (k) states that marten habitat areas shall be distributed every 2 to 2 1/2 miles and be a minimum of 160 acres in size. See Figure 3.11 for pine marten habitat in the South Deep Project area. It also specifies that these areas would be composed of conifers in old growth or mature successional stages with crown closure of 50 to 100 percent. As with other Management Indicator Species, an expanded narrative on required habitat conditions is included in the Forest Plan Final Environmental Impact Statement Appendix.

Within each broad biophysical environment, a cover type describes stands conditions on National Forest System lands. Cover types provide an indication of the tree size currently on that site. Cover types are further divided by canopy closure, from very dense to very open. The Colville National Forest also identifies some open (non-cover) types such as rock or water. Marten generally occupy older stands that contain multiple stories of trees and abundant down wood. They mainly locate their natal dens, dens in which they give birth, in holes in down or standing trees, the entrance to which usually lies beneath the snow. During winter, marten hunt on and below snow, accessing subnivean areas through conduits such as live trees, snags and rocks. Several of their main prey species inhabit riparian areas. There are about 27,319 acres on National Forest System lands in South Deep in the four biophysicals that are capable of producing marten habitat. The remaining Forest Service acres are in some non-cover type designation.

An abundance of large, down wood seems to be key in supporting marten: areas of low abundance of down wood probably do not support many marten (E. Bull, pers. comm.). Biological and environmental agents have contributed to the amount of dead and down wood in many areas of the South Deep Watershed.

## *Pileated Woodpecker (Dryocopus pileatus): Affected Environment*

The Forest Service selected pileated woodpeckers as indicators for Douglas-fir and cedar/hemlock old growth-dependent species. The habitat capability objective listed in the Forest Plan is to maintain habitat capable of supporting a viable population as described in the Forest Plan and Appendix of the Final Environmental Impact Statement.

Habitat requirements for a viable population of pileated woodpeckers are described in the Forest Plan Final Environmental Impact Statement Appendix K. While there are distinct pileated management requirement areas, the maintenance of suitable habitat is also to be accomplished within other areas (MA-1, 10 and 11). Forest Plan standard 4-39 (a) states that pileated MRs shall be distributed every five miles and that 300 acres of conifers in old growth or mature successional stages should be maintained for reproductive habitat and an additional 300 acres maintained for foraging. See Figure 3-11 for pileated woodpecker habitat in the South deep Project area.

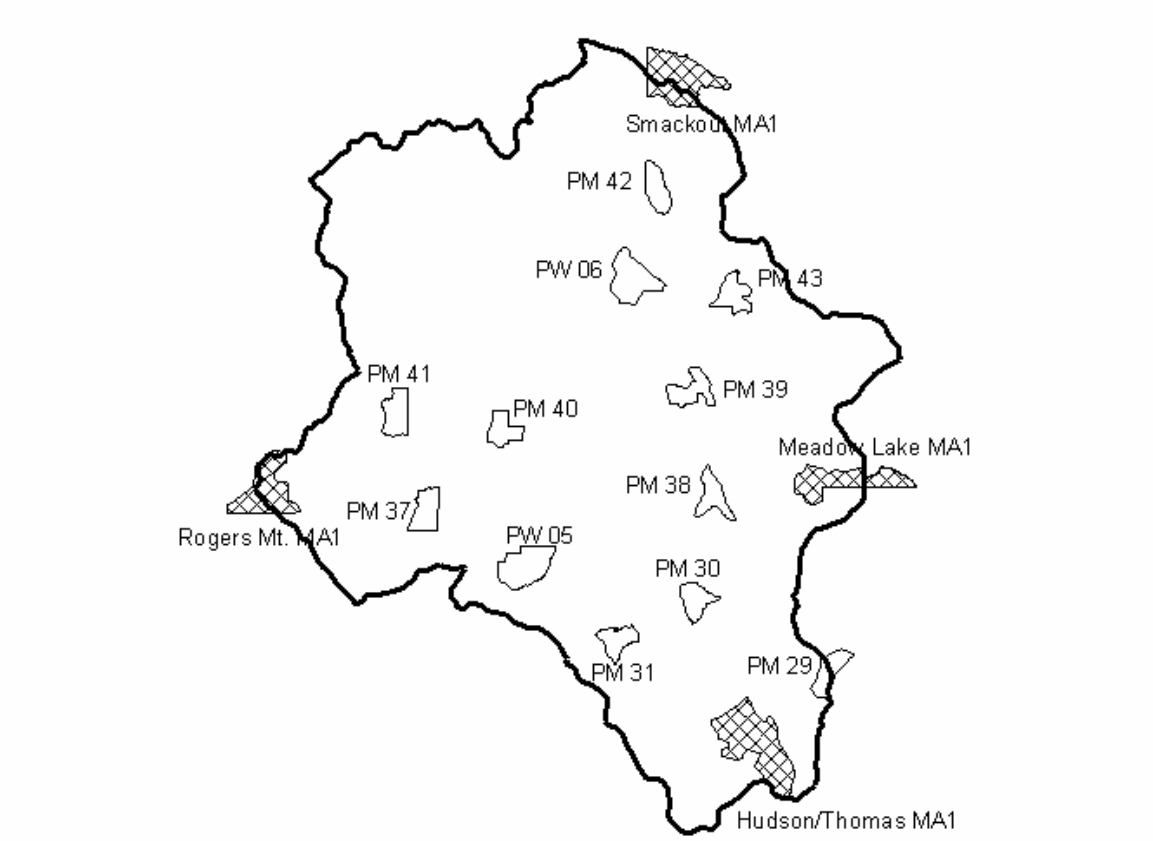



**Figure 3-11. Pine Martin, Pileated Woodpecker, and Barred Owl Habitat**

## *MA-1 (Barred Owl (***Strix varia***): Affected Environment*

The Forest Service selected the barred owl as an indicator of low elevation mature and old growth forests. The habitat capability objective listed in the Forest Plan is sufficient suitable habitat to sustain a viable population. The Plan also has a forest-wide goal of 73 pairs for the first decade of the plan. An assumed objective is habitat capable of supporting a pair of barred owls and their young within each MA-1. See Figure 3-11 for barred owl habitat in the South Deep Project area.

### Existing Snag Habitat

Snag levels are generally adequate to high throughout National Forest System lands in the South Deep Planning Area due to active fire suppression and limited harvest history. Levels of snags and down woody debris are generally sufficient to support barred owls on National Forest System lands. Harvest on National Forest Service managed lands done in more recent years had Plan direction for adequate snag levels set at 60% of the potential population of primary excavators. Since 1995, projects have been designed to manage for 100% of the potential population of primary excavator. The older Forest Service harvests likely did not retain many, especially large, snags so those units generally won't support barred owls now or through another harvest rotation. Snag levels on National Forest System lands are higher in riparian areas, disease pockets, or areas where insect outbreaks are occurring. Snag levels often are lower on private/other ownership.

## Beaver (*Castor canadensis*): Affected Environment

The Forest Service selected beavers as indicators of riparian areas dominated by aspen or willow. The habitat capability objective is improved habitat from 1980 conditions. The Forest Plan standards and guideline 4-40 (g) specifies that beaver habitat would be maintained or enhanced.

Beavers inhabit several of the drainages and Big Meadow Lake. Coniferous trees rather than aspen, willow and cottonwood (hardwood) trees dominate overstories along most of the banks of the creeks, though several sections contain good stands of hardwood trees and shrubs. Hardwood trees and shrubs that beaver eat require disturbance to regenerate. The lack of major disturbances in the watershed, principally fire, has resulted in loss of forage for beaver. No issues relating to analysis elements for beaver or their habitat were raised during scoping.

## Blue Grouse (*Dendragapus obscurus*):Affected Environment

In winter, blue grouse frequent open areas on upper slopes and ridges. In summer they occupy open, park-like stands at mid elevations. Lack of fires, and consequently succession, has resulted in shrubs and trees encroaching on open areas that blue grouse inhabit in summer, thus reducing the extent of this habitat. The issue of the need for large trees, raised during public scoping, relates to management of blue grouse winter habitat.

Partial harvest of trees on more open, dry sites would have a beneficial effect on blue grouse nesting and brood habitat by opening the understory. Regeneration harvests that leave a minimum number of trees eliminates blue grouse habitat in the short-term. Partial harvest of trees combined with prescribed fire would have a greater beneficial effect by opening the understory and stimulating vegetation. Noxious weeds spread reduces blue grouse habitat. The amount of road construction provides an index of the amount of disturbed soil, and thus of noxious weed spread.

The Forest Service selected blue grouse as a management indicator species due to its dependence on winter roost habitat and nesting habitat. The habitat capability objective is to maintain blue grouse roosting and nesting habitat quality and quantity. Forest Plan standard and guideline 4-40 (e) states that blue grouse habitat should be managed by providing a minimum of eight mature, "limby" Douglas-fir or subalpine fir trees per acre on or near ridge-tops in park-like or open timber stands. It also states that hiding cover around at least 50 percent of the perimeter of springs or other water sources should be maintained with no break in cover exceeding 600 lineal feet along the waters edge.

## *Affected Environment*

### *Summer Nesting Habitat*

Nesting and brood habitat consists of open, park-like stands at lower elevations, often maintained by fire. Lack of fires and subsequent succession resulted in shrubs and trees encroaching on these stands, thus reducing their extent and quality. Much of the mid and lower elevations of the watershed supported more open, park-like stands than currently exist (Schellhaas et al. 2000). About 43,150 acres could have supported blue grouse habitat, about 62% of which lies on National Forest System lands. Most of this now consists of relatively closed-canopy stands and provides poor habitat.

#### Winter Roosting Habitat

In winter, blue grouse tend to occupy habitats along ridgelines, where they roost in Douglas-fir or subalpine fir in somewhat open, park-like stands (Perkins et al. 1991). This habitat is important because winter is the “bottleneck” period when food resources usually are least but energy demands on the birds are greatest. Using aerial photos, topographical maps and field surveys, there are approximately 11,500 acres of potential blue grouse winter habitat, 97% of which lies on National Forest System land. About 1,800 acres of this area have been harvested in the past. About 60% of the harvest was regeneration harvest, and slightly more than 80% of the harvest occurred on National Forest System land. Not all of the harvested areas provided blue grouse habitat, but the acreage that contained large trees is not known.

The issue of the need for large trees, raised during public scoping, relates to management of blue grouse winter habitat.

# Franklin's Grouse (*Falcipennis canadensis franklinii*): Affected Environment

The Forest Service selected Franklin's (spruce) grouse as an indicator species to represent lodgepole pine-dependent species. The habitat capability objective is to approximate 1980 Franklin's grouse habitat conditions.

Franklin's grouse habitat is described as large stands of young lodgepole pine, often the result of stand-replacement fires. The Forest Plan (page 4-40) directs that large areas dominated by lodgepole pine stands be managed to maintain 20% in young age classes.

About 14,750 acres of lodgepole pine, lodgepole pine/Douglas-fir or lodgepole pine/larch exist in the watershed, about 70% of which lies on National Forest System lands. No large blocks of young lodgepole pine exist in the watershed, and lodgepole pine-dominated stands cover only about 1,840 acres (English et al. 1999). Of the nearly 2,830 acres of past harvest within these stands, about 1,150 acres were harvested using regeneration prescriptions, thus could provide some good Franklin’s grouse habitat. However, because of the lack of young lodgepole pine-dominated stands, most current habitat is marginal.

# Northern Three-toed Woodpecker (Picus tridactylus): Affected Environment

Little high-quality Northern three-toed woodpecker habitat occurs in South Deep. Most of the densely stocked small diameter stands do not have the characteristics of the later structure lodgepole, including larger snags. Pine marten and pileated woodpecker management requirement areas and the MA-1 areas provide some additional habitat that does not have timber

harvest. Snag habitat is generally good in South Deep in those area that are not densely stocked small diameter stands, though some of the older harvest units may not have many snags.

## *Affected Environment*

The Forest Service selected Northern three-toed woodpeckers to monitor effects to mature lodgepole pine and subalpine fir stands. The habitat capability objective is to maintain habitat of sufficient size and quality to support a viable population. Forest Plan standard 4-39 (b) states that 75 acres of lodgepole pine or subalpine fir in old growth or mature successional stages would be maintained for the northern three-toed woodpecker and distributed every two miles. The Forest Plan assumes that management requirement areas set up for marten would meet the management requirements for northern three-toed woodpeckers (page F-17 and K-24 Final Environmental Impact Statement Appendices). Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (1994), previously known as "screening" and incorporated into the Forest Plan (5 June, 1995, amendment), increased the number of required snags per acre. Additional old growth habitat may also be provided in other non-harvested areas (MA-1, MA-10, MA-11).

### Late-successional and Old Growth Lodgepole Pine and Subalpine Fir Stands

The Mount Rogers area has the largest block of subalpine fir biophysical and more of it has some of the bigger trees that approach the later structure most beneficial to this species. There are two other blocks of the subalpine fir biophysical within South Deep. Both of these areas are in the southwestern part of South Deep in the Green Mountain area. Neither of these areas has much SS5 habitat, which is nearest to late structure classification.

There are many acres classified as relatively even-aged densely stocked small diameter stands located primarily in the southern and western parts of the South Deep watershed. Not all of these are lodgepole dominated. Also many of them are not classified as SS5 (middle) or SS6 (late). Because of their fire disturbance origins, these types of stands are slow to or never develop into the bigger lodgepole type stands that Northern three-toed woodpeckers use.

### Marten MRs

The Forest Plan strategy of placing marten management requirement areas on a grid system does allow placing these areas in the best available habitat. Preliminary pine marten and pileated woodpecker management requirement areas and the MA-1s have been identified on the National Forest System lands in South Deep. One of the selection criteria for establishing these areas is their current or potential for older stands with large tree and snags. The preliminary management requirement area mapping was cursory, so areas with greater concentration of later structure may have been missed initially. Also, the grid constraints limit how well these management requirement areas and MA-1s provide conditions for Northern three-toed woodpeckers. Pine marten management requirement areas, including the pileated woodpecker and barred owl areas that are intended to provide marten habitat, are expected to provide habitat for Northern three-toed woodpeckers. See the marten discussion for habitat information.

### Snag Habitat

Large snags are generally adequate in South Deep watershed with the exceptions of some older harvest units and some of the densely stocked small diameter stands. Insect and disease events and weather damage to trees have created snags in the general forest area.

Harvest records indicate that about 21,000 acres have been harvested on all ownerships in the South Deep watershed in the past 30 years (including those acres that are included in the 2002 Forestry Practices applications). Harvest prescriptions on these National Forest System lands are varied and range from some form of regeneration to various types of thinning harvest.

Only the most recent Forest Service sales are likely to retain the amount of snags currently required by the Forest Plan after the "screens" amendment in 1994. Stony and Rocky are two

more recent Forest Service sales that should meet those requirements. About 1,000 acres in these two sales have been harvested more recently (1997 or later). There may be exceptions if larger trees were not present or if safety regulations require snag removal. Older harvest units in older sales very likely do not retain close to the amount of snags currently required. Those acres may not support Northern three-toed woodpeckers. Almost ¼ of the South Deep watershed is in other ownership; therefore, it cannot be assumed any level of snag retention when those acres are harvested.

# Other Woodpeckers: Affected Environment

See discussions of effects to snag habitat and of cumulative effects for Northern three-toed woodpecker and pileated woodpecker in those respective sections. Snags are adequate overall on National Forest System lands in the South Deep watershed, though some older units and some of the densely stocked stands do not provide larger snags. Care must be taken to minimize loss, especially of larger snags, during harvest. The District Wildlife Tree Marking Guideline Update (1995) is in effect for South Deep watershed and would be applied in harvest units. This update requires retaining a minimum of 4 large snags and 8 replacement trees per acre, when available, to provide for 100% of the potential population of primary cavity nesters. It describes sizes and alternatives if these are not available. If the number of remaining snags does not meet the requirements in this guideline, the loss, due to harvest, can be mitigated by creating snags.

## *Affected Environment*

The Forest Service selected the category of "other woodpeckers" because of their dependence on snag habitat. The habitat capability objective cited in the Forest Plan amendment (Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (1994)) is to provide sufficient snags to support 100% of potential woodpecker populations in all areas. Forest Plan standard and guideline 4-39 (c) reinforces the habitat capability objective and specifies that green replacement trees shall be retained to provide for 100% population levels over a full rotation [(Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (1994), previously known as “screening” and incorporated into the Forest Plan (5 June, 1995, amendment)] and increased the number of required snags per acre. The Three Rivers Ranger District (east) developed and adopted a wildlife tree marking guideline in 1995 to address the 1994 Forest Plan amendment that increased the requirement to manage for 100% of potential woodpecker populations, up from 60%. That guideline prescribes a minimum of 4 large snags and 8 replacement trees per acre where available (D1 Wildlife Tree Marking Guideline Update 1995) and gives guidance when those conditions cannot be met. It is in effect for this project.

The effects on other woodpeckers would be directly related to changes in available snags. In the whole South Deep watershed, timber harvest has occurred on approximately 21,000 acres on both Forest Service and other ownership in the last 30 years (through 2003). Approximately 1,000 acres harvested on National Forest System lands from 1997 to present are expected to meet the snag standards. The balance of treatment acres (both earlier Forest Service and any of the other ownerships) might not be expected to contain enough snags to meet Forest Plan standards.

This assumption is supported by the use of DecAid (Mellen et al. 2003), a database released by the Forest Service in 2003 that contains information about snags and wildlife. Data compiled from existing, unharvested stands in northeastern Washington indicates that in the mixed conifer forest, large snags are not common: nearly 90% of the plots surveyed contained 4 or fewer snags larger than 20” in diameter per acre (Chart 3-7). Snags between 10” and 20” in diameter are more common, though 60% of the unharvested plots contained fewer than 6 snags per acre (Chart 3-8). Harris (1999) found a similar situation when he compiled data from Forest Service vegetation plots in Region 1, which includes most of the Northern Rocky Mountains.

General observations indicate that snag and down wood levels on National Forest System lands in the South Deep watershed are similar to levels found in other areas: sufficient small snags and down wood and infrequent large snags and down wood. Most mixed conifer stands affected by fire in the 1920s and 1930s follow a similar pattern: few or no snags more than 20" diameter but adequate numbers of smaller snags. In the past several years, large-scale mortality from Douglas-fir bark beetle, blowdown from wind events and to a lesser extent root rot have increased the number of large snags and down wood. No large fires have occurred in the watershed in the past 50 years, so aside from these other disturbances, no concentrations of snags exist.

**Chart 3-7. Distribution of the unharvested area of the EMC_NCR_S Vegetation Condition among snag density classes (#/acre) for snags more than 20 inches diameter at breast height, based on 406 unharvested inventory plots. Graph based on data in DecAid, which expresses values as snags/ha.**

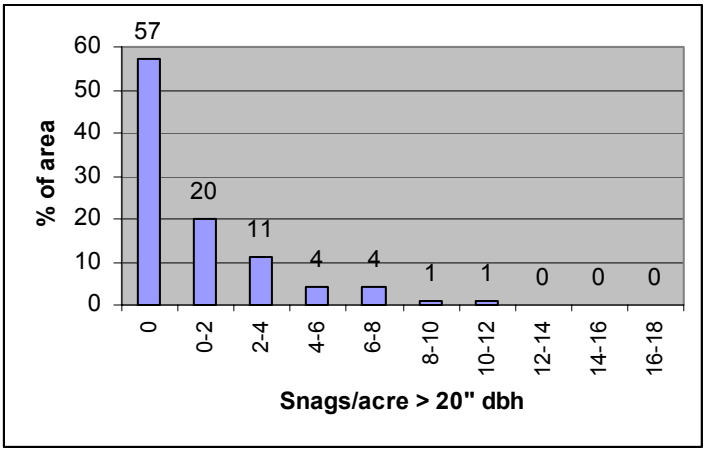
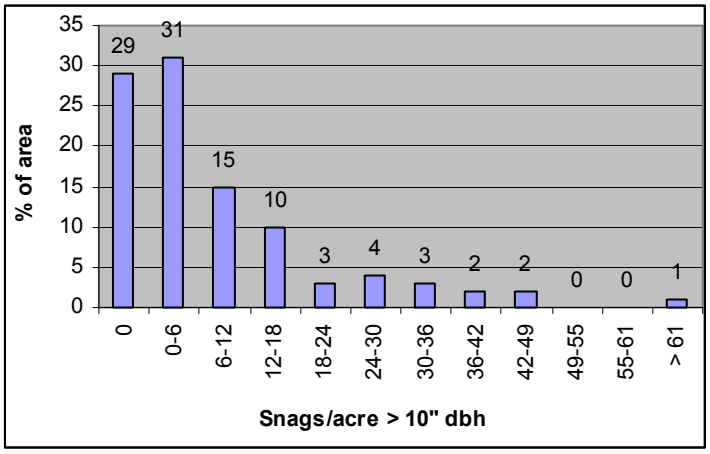



**Chart 3-8. Distribution of the unharvested area of the EMC_NCR_S Vegetation Condition among snag density classes (#/acre) for snagsmore than 10 inches diameter at breast height, based on 406 unharvested inventory plots. Graph based on data in DecAid, which expresses values snags/ha.**



# Large Raptors (and Great Blue Herons): Affected Environment

Two goshawk/raptor surveys have been conducted within the South Deep watershed. One was in 1998 and the other was in 2002. One goshawk nest has been documented within this watershed since 1992. No additional goshawk nests have been found within the watershed. Two Cooper's hawk nests and a red-tailed hawk nest have been found within the watershed.

The goshawk nest is located within an existing MA-1.

Herons have not been found nesting in the South Deep watershed, although herons do use portions of the watershed. A single heron nest is documented just outside the planning area to the southeast. A heron rookery also is documented to the southeast of this watershed. The rookery had been active for several years, but may have been abandoned because birds were not seen at that heronry in 2001, 2002, or 2003. Herons are not discussed in detail in this analysis because nests have not been documented in the watershed. If any nests are found later in the project implementation, the nests would be protected.

# Trout: Affected Environment

Trout species listed in the Colville National Forest Plan are discussed in the Forest Service Sensitive Species and the Fisheries sections of this document.

# Migratory Land Birds: Affected Environment

Migratory birds utilize a variety of habitats, including upland coniferous forests and riparian zones. Activities such as grazing, development, timber harvest, underburning, and projects that affect riparian areas may affect some individuals of some species. Some activities have fragmented forests. Exotic species invasion is often promoted by some human activities. Currently, much of the riparian habitat in the planning area is altered from historical conditions, especially on other ownerships. A few locations in South Deep provide larger areas of riparian habitat. These include wetlands near and at Big Meadow Lake, the area called Rabbit Creek, and areas that have deciduous trees including areas near the Paradise and the junction between Meadow Creek road and Byers Creek Road. Small stands of deciduous trees are found in other areas throughout the project area. The large opening on the southern side of Aladdin Mountain (primarily located in T. 37 N., R. 41 E., Section 10) has some higher elevation sagebrush habitat that may provide specialized habitat for some migratory birds. Generally, projects that improve riparian shrub and deciduous tree conditions also would provide improved nesting and foraging opportunities for several species. Many upland locations reflect the history of fire exclusion with dense ingrowth of other tree species. Some migratory bird species may benefit from the type of silvicultural treatments proposed, but the effect could be detrimental to some species. Underburning generally would provide improved shrub and forb conditions that can benefit some species, but some nests may be destroyed during some spring burns. Often, there are trade-offs between limited disturbances over a short period to gain longer-term habitat improvement for a species. All of these habitat changes would affect a small area relative to the ranges of these species and should have little effect to a whole species.

Several migratory bird species have been experiencing population declines and concern for this group is growing. Migratory birds are not Management Indicator Species for the Colville National Forest, but they were identified as a group of interest during the watershed analysis because of some species use of riparian areas. Recently, several important actions related to migratory birds have occurred. The Neotropical Migratory Bird Conservation Act was signed into law on July 20, 2000. The U.S. Department of Agriculture Forest Service Landbird Strategic Plan was issued in September, 2000. The Forest Service and U.S. Department of the Interior, Fish and Wildlife

Service have developed a Memorandum of Understanding to strengthen migratory bird conservation (January 17, 2001). Multiple agencies have been involved in the development of general guidelines for land bird conservation in eastern Oregon and Washington (Altman, B. 2000). On January 10, 2001, President Clinton signed an executive order outlining Federal agencies' responsibilities to protect migratory birds. The 125 land birds highly associated with breeding in habitats in parts of the Northern Rocky Mountains in Oregon and Washington includes many neotropical migratory bird species (Altman 2000).

This section of the Management Indicator Species document discusses migratory birds relative to several conservation issues. Riparian areas, areas with deciduous trees, and unique areas such as those containing higher elevation sagebrush habitat are more limited than the most of the coniferous forest habitat, although SS7 also provides important habitat for some migratory birds. Species requiring the large tree, single stratum habitat (SS7) may have undergone greater declines over time than other species that primarily use coniferous forest habitats. Other analyses for projects in the dry forests of eastern Washington and Oregon have addressed issues related to migratory land birds. This analysis tiers to those efforts. Upland projects were not designed for specific migratory landbird issues.

## *Affected Environment*

### Amount of Nesting Habitat

Different migratory land bird species utilize different habitats for nesting. Many associate with deciduous trees and shrubs such as those found in riparian areas, but others nest in upland coniferous forests. Different species also use forest stands ranging from early successional to late successional stage. Some species are ground nesters using forest or meadow settings. Potentially the entire South Deep watershed offers nesting habitat of varying quality to a variety of species.

Riparian areas provide potential nesting habitat for many migratory bird species. In the South Deep watershed, some of the riparian vegetation has been reduced or eliminated, especially on other ownerships. Within the National Forest System lands, grazing, timber harvest, and other management activities have impacted some wetland riparian habitat. Other portions of streams that are on National Forest System lands are generally in a more upland setting. Often these creeks did not have a large riparian zone, but occurred within a general forest matrix. Forests often have greater canopy cover today than was present historically and conifer species composition is also changing. These changes are probably causing a shift in bird composition as well. Habitat that is in short supply is primarily Structural Stage 6 habitat, which may be assisted by harvesting and burning in some stands.

### Surveys

No surveys were conducted specifically for migratory land birds, but many species have been observed in portions of this watershed. The relative abundances of different species have likely shifted over time due to past management such as old homesteads, cattle grazing (portions of Meadow Creek Allotment, Aladdin Allotment, and Smackout Allotment), and fire suppression. With fire suppression, encroachment of more shade tolerant species is occurring. Insect outbreaks have changed some of the coniferous habitat. National Forest System lands in the South Deep watershed has had quite a bit of commercial timber harvest. Most of the migratory land bird species that would use the habitats present in the South Deep watershed are expected to currently occur here, though the abundances may be different than what would have been present in the reference time period.

## Waterfowl: Affected Environment

Waterfowl use parts of the South Deep planning area. Big Meadow Lake is the most prominent area for waterfowl habitat, but other wetlands both on and off the Forest provide additional habitat for some cavity nesting ducks. Cavity nesting ducks are the species most likely to be impacted by timber management activities. Considering that some cavity nesting waterfowl can nest up to one mile from water, a large amount of habitat could be affected by harvest activities. Five species may occur within this watershed. All of them are poor pioneers of unoccupied habitats and commonly have high nest site fidelity, so destruction of cavity trees may eliminate these species from an area. Buffleheads (*Bucephala albeola*) are of particular interest because The Washington Department of Wildlife's Priority Habitats and Species document about cavity nesting ducks indicates that bufflehead are only known to breed at two places in northeastern Washington. One of these locations is Big Meadow Lake. Common goldeneyes (*Bucephala clangula*) are also known to breed in only a few isolated areas in northeast Washington and one of these areas is around Big Meadow Lake. Wood ducks (*Aix sponsa*) are known to breed in a few more places in northeast Washington than the other two species, but they also are not common. Because buffleheads are the most restricted and because all cavity nesting ducks have similar requirements, this section focuses on buffleheads.

### Amount of Nesting Habitat

The current amount of nesting habitat for buffleheads is not known. These birds use snags and cavity trees near suitable wetlands. Optimal brood habitat for all cavity nesting ducks is within ½ mile of shallow wetlands. Big Meadow Lake, the associated wetlands and the surrounding forest habitat provide good conditions for these cavity nesting birds. Buffering those wetlands at Big Meadow Lake indicates there is approximately two square miles of potential habitat in that area. If some of the other nearby wetlands are included, such as Byers junction, the amount of potential nesting habitat increases to about three square miles. Besides buffleheads and other cavity nesters, Big Meadow Lake and nearby wetlands provide habitat for many other species of ducks and Canada geese. Other wetlands on and off the National Forest System lands provide habitat for other waterfowl.

### Surveys

We have not conducted formal surveys, but wildlife personnel and other employees do monitor the kinds of ducks and geese present at Big Meadow Lake. Naturewatch bird walks at Big Meadow Lake track species observed over several years.

# 3.2.7 Fisheries: Affected Environment

Several watersheds are found within the South Deep Project area. The largest of these watersheds have been surveyed for physical habitat condition using the Hankin-Reeves survey protocol in the last decade. The remaining watersheds have been informally surveyed.

Continuous water temperature data was available for some of the streams within the project area. The 7 day average of maximum daily temperatures is 14.9 C (58.8 F), 15.9 C (60.6 F), 12.8 C (55.1 F) and13.1 C (55.6 F) for Rogers, Meadow, Rocky and Clinton creeks respectively in 2001 and 2004 (Bisson 2005). No stream temperature data is available for the South Fork of Deep Creek. Although limited, the data indicates that present water temperatures in streams do not meet the 48 degrees Fahrenheit maximum, which is the Inland Native Fish Strategy riparian management objective for water temperatures for spawning and rearing habitat for bull trout. These temperatures do, however, meet state water quality standards for these particular streams, which is a maximum of 16 degrees Celius (61 degree Fahrenheit).

## South Deep Creek

South Deep Creek is a perennial, Class II (fish-bearing), fifth-order tributary of Deep Creek. The stream is approximately 12.2 miles in length and flows through a wide valley form at an average gradient of approximately 1.1%. Habitat in a sinuous, low gradient stream like South Deep Creek is often composed of glides, low gradient riffles and a combination of straight and lateral scour pools. These low gradient reaches typically provide excellent fish cover and habitat. However, degraded streambanks, increased levels of instream sediment, increased width to depth ratios, poor canopy cover and low large woody debris recruitment potential are suspected to have had a negative effect on habitat quality and complexity along the mainstem of South Deep Creek watershed. Roads, vegetation clearing, and grazing pressure are suspected to have contributed to degraded habitat conditions in the creek (South Deep Watershed Analysis 1999). Surveys for species presence have not been conducted on this stream.

## Kolle Creek

This stream is a tributary of the South Fork of Deep Creek. Kolle Creek has been informally surveyed for physical habitat characteristics and has been electrofished within the analysis area. No fish were found. The riparian vegetation is fully functional and continuous throughout its length on National Forest System lands. Within the analysis area, Kolle Creek watershed has a low density of roads and steep terrain. During summer months lower portions of the stream on private lands become intermittent. This fact likely explains the reason Kolle Creek is non-fish bearing on National Forest System lands. Livestock use occurs on private lands where a road intersects the stream near its mouth. Riparian areas are grazed heavily on these private lands and limited bank sloughing and compaction is occurring in this section of the stream.

## Clinton Creek

Clinton Creek is also a tributary to the South Fork of Deep Creek. It has been informally surveyed for physical habitat characteristics and electrofished within the analysis area. No fish were found. The watershed on National Forest System land also has a low density of roads and very steep terrain. Riparian vegetation is fully functional and continuous within the analysis area. Water temperatures taken in July 2000 indicate that maximum water temperature reached 13 ˚ C. at the upper portion of main Clinton Creek, while reaching a high of 12 ˚ C. in the upper South Fork.

The lower portion of this creek is on private land where it flows through pasture land that is heavily grazed. This portion of the stream has not been surveyed. However, the riparian vegetation appears to be very narrow and lacking in overhead shading due to an absence of overstory. Clinton Creek is perennial and non-fish bearing on National Forest System lands, due to a gradient barrier. Brook trout can be found on the lower portion of the creek.

## Rogers Creek

Rogers Creek is a perennial, Class II (fish-bearing) tributary to the South Fork of Deep Creek. The main stream has been surveyed for physical habitat characteristics and contains westslope cutthroat and brook trout. Both species are absent in the two forks, above the main stream, due to gradient barriers. Water temperatures taken in July 2000 indicate that maximum water temperature reached 15˚ C. at the Aladdin highway intersection near the mouth of Rogers Creek, while reaching a high of 12˚ C. in the upper South Fork.

The creek is a riffle dominated step pool system with a B channel type. Streambank stability is excellent and riparian vegetation is continuous with good crown closure. This portion of the stream has a low frequency of pools but within what can be expected for this type of channel.

There is an abundance of large instream woody debris (327 pieces per mile). Embeddedness is low within a streambed substrate dominated by gravel-sized material. This watershed has a low density of roads and steep terrain. Livestock use of the riparian area is minor where one road intersects the South Fork of Rogers Creek.

## Scott and Kenny Creeks

These streams are tributaries to the South Fork of Deep Creek. They have not been surveyed for physical habitat characteristics due to their intermittent nature on National Forest System lands. A majority of this watershed on National Forest System lands has very steep terrain with streams of moderate to high gradient stream channels. Riparian vegetation is fully functional and continuous although narrow in width. The lower portion of Scott and Kenny Creeks flows through private pasture lands that are heavily grazed. These sections of stream on private lands have not been informally or formally surveyed.

## Meadow and Byers Creek

Meadow Creek along with a major tributary, Byers Creek, have been formally surveyed for physical habitat characteristics. Meadow Creek is fish bearing, containing coastal rainbow and brook trout. Finclips of tissue from the rainbow trout were genetically analyzed and found to be coastal redband and not redband trout. Byers Creek is also fish bearing, containing cutthroat and brook trout. The cutthroat trout have not been genetically analyzed. Physical characteristics of these fish are indicative of pure westslope cutthroat. Water temperatures taken in 2000 indicate that maximum water temperature reached 14.5˚ C. in the upper end of this watershed.

Meadow Creek is a fourth order Class II tributary of South Deep Creek, flowing predominantly through a low to moderate gradient (average gradient of 3%), unconfined to moderately confined channel. Cobble dominates the lower reaches, shifting to gravel and sand dominance in the upper reaches. Low gradient riffles, dam pools, scour pools and plunge pools are characteristic of low to moderate gradient channel types. This type of habitat typically provides good to excellent fish habitat.

Byers Creek is a perennial third order tributary of Meadow Creek. The lower 1.5 miles of Byers Creek have a relatively even ratio of pools to riffles. Habitat in a moderately confined, low to moderate gradient stream like lower Byers Creek is typically composed of low gradient riffles, dam pools, straight scour pools and lateral scour pools. The substrate was dominated by gravel and sand in this lower stream section. Large woody debris and undercut banks provided the dominant forms of cover for fish on the lower section of Byers Creek (Evans et al. 1999).

Meadow and Byers Creeks are riffle dominated step pool systems with B channel types. Streambank stability is excellent where riparian vegetation is continuous with good crown closure. The lower portion of the watershed has continuous riparian vegetation located within steep terrain on the lower reaches of Meadow Creek. However, in the upper end of the watershed, previous clearcut harvesting has removed the riparian vegetation along both Meadow and Byers Creeks. Primary livestock access occurs where roads intersect the streams and within harvest units adjacent to the streams. Compaction and bank sloughing occur in these areas. The riparian vegetation, along these clearcuts, is recovering and streambanks are becoming more stable although full expression of the vegetation has yet to occur in places.

The streams have a low frequency of pools for the type of channels. One of the major contributing factors to this low frequency is soil movement from the county and forest road system into the streams which can fill pool habitat. A lesser factor is limited streambank erosion due to overuse by cattle. There is an abundance of large instream woody debris (179 pieces per mile) for Meadow Creek and (213 pieces per mile) for Byers Creek. Embeddedness is high within a streambed substrate dominated by sandy material in both Byers and Meadow creeks.

# Rocky Creek

Rocky Creek is a third-order Class II tributary of South Deep Creek flowing predominantly through a low to moderate gradient (average gradient of 4%), unconfined to moderately confined channel. It has been formally surveyed for physical habitat characteristics and has been electrofished for fish presence. It contains westslope cuthroat and brook trout. Finclips of tissue from the cutthroat trout were genetically analyzed and found to be pure westslope cutthroat trout.

Within National Forest System lands, habitat in the first reach of Rocky Creek (first 0.5 mile above property boundary) was heavily influenced by beaver activity, composed of a complex series of beaver dams, dam pools and side channel habitat. Sand and gravel dominate this lower reach. Beaver activity dropped off above this point, with a corresponding increase in gradient and a more confined stream channel, with channel shaping/forming processes primarily influenced by the amount and location of large woody debris. Substrate was dominated by gravel/cobble and cobble/gravel over the next two reaches (approximately 1.25 miles). Low gradient riffles, dam pools, scour pools and plunge pools are characteristic of this type of low to moderate gradient streams. This type of habitat typically provides good to excellent fish habitat.

When compared to Inland Native Fish Strategy riparian management objectives, the desired pool frequency was not met in any reach surveyed on Rocky Creek. Similarly, water temperature failed to meet the desired less than 48˚ Fahrenheit temperature standard for spawning/rearing salmonids in all reaches surveyed, with a maximum temperature of 56 ˚ Fahrenheit, recorded. Large woody debris frequencies met desired riparian management objectives values for the lower two reaches. Width to depth ratios were high in all three surveyed reaches of Rocky Creek, ranging from a low of 17.9 to a high of 24.8 (South Deep Watershed Analysis 1999). The Inland Native Fish Strategy riparian management objective for wetted width/depth ratio is less than 10.

# Cumulative Effects of Past Activities on Fisheries

## *Past Timber Harvest*

Timber harvest in riparian areas was not prohibited until 1995, and therefore, streams in the past were often impacted by logging activities. Riparian harvest on National Forest System lands was concentrated along Meadow and Byers Creeks within the analysis area during the early 1980s. These areas have had 20+ years to recover and this riparian vegetation is functioning well except in an isolated livestock watering area along Byers Creek adjacent to a road crossing. Since 1995, when riparian conservation areas were established, much of riparian vegetation in the analysis area has been undisturbed by timber harvest.

Timber harvest can increase total water yield, increase peak flows and decrease summer low flows due to changes in forest cover. Timber harvest in riparian areas may also increase water temperature (see Hydrology Section). However, as young trees mature and forest cover increases, these effects are expected to decline. All even age harvest areas on National Forest System lands in the analysis area are in some stage of transitioning into fully functioning timber stands. The percentage of acreage of National Forest System lands in the analysis area in open condition has greatly decreased since the 1980s. This is due to the fact that most past even age harvest areas are now 15 to 45 year old stands with partial to full forest canopy closure and current selective harvest and commercial thinning prescriptions do not create large openings. Barring unforeseen natural events such as wildfire, this trend is expected to continue.

## *Roads*

Approximately 220 miles of Forest Service and county roads are within the South Deep analysis area.

**Table 3-11. South Deep Road Densities**

| Watershed | Total Road Miles | Total Rd Density | Riparian Road Miles | Riparian Rd Density |
|---|---|---|---|---|
| Meadow Creek | 67.97 | 4.68 | 9.3 | 0.64 |
| Rocky Creek | 69.75 | 3.17 | 11.6 | 0.53 |
| South Deep tributaries | 81.80 | 2.38 | 11.2 | 0.36 |

About 36 miles of road are located within 200 feet of a stream or wetland. Road densities vary by subwatershed, with Meadow Creek having the highest road density and the South Deep tributaries the lowest. The specific effects of the existing road systems on the subwatersheds of the South Fork of Deep Creek are not defined in the existing collected information. Specific hydrographs do not exist for each subwatershed for detailed flow regimes, no control subwatersheds exist (similar watersheds with little to no road construction) for comparison if such data existed. The actual level of sediment input from roads in these watersheds is not known since the natural level of erosion into these streams is not known. It is known that the fish habitat in these streams with the present level of roads is still suitable for three trout species and one species of sculpin. These species persist in fish-bearing streams and successful reproduction is occurring as evidenced by the representation of different age classes of the four species present. It should be noted that existing conditions, while suitable for fish, can not be considered optimal due to the continued input of sediment from the use and maintenance of the existing road system and other sources of human activities.

Forest Service roads within the planning area will continue to be maintained at slightly reduced levels in the future due to anticipated declining road maintenance budgets. There are presently 4 culverts on Forest Service roads that are, at least seasonally, blocking upstream fish passage. These four culverts are located on Roads 7018000, 7018140, 7018200 and 1700259 in the Rocky, Meadow and Byers Creek subwatersheds. Approximately 8 miles of suitable spawning and rearing habitat are unavailable to salmonids for at least part of the year. These miles above these culverts do, however, support a viable resident fishery of westslope cutthroat and/or brook trout. The culvert on Rd. 7018140 will be removed after the South Deep Timber Sale is completed, providing access to approximately 1 mile of suitable habitat for westslope cutthroat and brook trout below the culvert. The other Forest Service culverts will be upgraded to meet fish passage requirements as funding permits. Stevens County will continue to maintain county roads within their right-of-ways in the planning area at their current standards. The effects of the existing level of road maintenance is the continued input of sediment from roads into stream systems where the amount of upland and/or riparian vegetation is not sufficient to filter out all soil movement.

# Section 3.3 The Human Environment

The oral history of indigenous people indicates the area lying between the Colville River valley and the Calispell Divide was not occupied when Kalispel peoples looking for a place to settle first viewed it.

Today, 5.8% of Stevens County's 39,000 people are Native American. People of European decent and others make up the remaining 94.2%. Fur-trappers and miners led the way for the in-migration of Europeans and others in the early to mid-1800s. Homestead settlement between 1890 and 1930 brought Stevens County's population to more than 18,000. This influx initiated the transition from reference landscape conditions to current conditions, when prospects for mining, timber, livestock grazing and crops lured people into the analysis area.

Most human uses today are compatible. However, there is some competition for area resources and conflicts arise as a result. Stevens County is the home of several sawmill operations.

# 3.3.1 Heritage Resources

Heritage resources are the physical remains of sites, structures, or objects used by humans in the past. They may be historic, prehistoric, archaeological, or architectural. Prehistoric refers to anything that predates written history. Historic refers to that period for which written records exist.

Very few prehistoric sites have been located within the Colville National Forest, but research indicates prehistoric use of uplands. Small hunting camps, tool manufacturing areas, rock shelters, graves, pictographs, trails, vegetable processing sites, and religious sites may exist within the Forest. The most common historic sites are homesteaders' log cabins. These numerous sites make up the bulk of the heritage sites on the Forest. Other historic sites include mines, mining camps, logging camps, wagon roads, splash dams, Civilian Conservation Corps camps, and early Forest Service Administrative sites, including abandoned fire lookout towers and old Forest Service trails.

Pursuant to the National Historic Preservation Act of 1966, as amended, the Colville National Forest conducts a program designed to identify, evaluate, preserve and protect cultural resources.

## Native

Native people of the region ranged freely over the hills and valleys hunting and gathering. Compared with many other areas of the Pacific Northwest, the population of native peoples living in Stevens County was relatively small.

The project area may have been occupied by several native groups, including Lakes, Colville, Kalispel, Kootenai, and Chewelah. These groups were part of the Plateau cultural tradition, and with the exception of the Kootenai, all spoke dialects of the Salishan language family. There are no known Native American cultural resource sites (on National Forest System lands) within the project area.

## European

The project area was largely unoccupied by non-Native Americans until the turn of the 20$^{th}$ century. The early 1900s was a period of settlement and development of lumber, mining and agriculture industries. Most homestead claims were patented between 1905 and 1920. Both valley bottom and uplands were patented, although upland areas were primarily used for wood cutting and grazing. To survive, settlers had to be versatile, often being logger, miner, trapper and farmer at the same time.

In the early 1900s, a number of small communities, such as Aladdin, were formed. The majority of the watershed burned in the 1920s. In the 1930s the Civilian Conservation Corps built a number of lookout cabins and telephone lines in the area.

By the 1940s a large number of mining operations had been located in Stevens County. With the catastrophic fire, the Great Depression, and the end of World War I, many industries began to decline, and a number of settlers abandoned homesteads, or sold lands to private companies or the federal government.

## Historic Properties

There are 43 identified historic properties within the proposed planning area. Of these, 14 properties are located within or near identified planning units, and have the potential to be affected. Past management practices have not identified any of these properties as having been evaluated for their eligibility to the National Register of Historic Places. Historic properties that are unevaluated are managed as if eligible, and mitigations for these properties will follow management prescriptions as specified.

## Cumulative Effects of Past Activities on Heritage Resources

Cumulative effects from past timber harvesting and road building on cultural resources cannot be accurately determined, because field inventories for historic properties did not begin until the early 1980s. It is likely that past activities have affected historic properties by increasing access and visibility of these properties.

# 3.3.2 Scenery: Affected Environment

The South Deep area has a characteristic landscape that consists of rolling hill landforms, continuous textured forested canopy with occasional rock outcrops. The landscape's vegetative element consists predominantly of Douglas-fir, western red cedar, grand fir, western larch, alpine fir, ponderosa pine, and lodgepole pine. Timber harvest is evident in the foreground and middleground of the Meadow Creek Road; and in foreground on private lands along the Aladdin Highway. Farming is present in the Aladdin valley and there are some homestead meadows evident along Rocky Creek. A Bonneville Power Administration transmission line crosses a small portion of the project area near the northern boundary. As discussed in the South Deep Watershed Analysis, the Historic Range of Variability suggests a landscape that in the past (prior to the reduction of wildfire impacts by fire suppression activities) a more open, less dense understoried, large diameter forest character existed.

The critical viewpoints for scenery analysis are views from the Aladdin Highway and the Meadow Creek Road and Big Meadow Lake. Most middleground and background views from the Meadow Creek Road are vegetatively and topographically screened; Aladdin Highway views are more expansive due to the wide valley bottom.

The Forest Plan Standard and Guideline is foreground Retention and middleground Partial Retention as seen from the Aladdin Highway (MA 5, 6); foreground Partial Retention and middleground Modification as seen from the Meadow Creek Road and Big Meadow Lake (MA 3A); and Modification for the remaining areas (MA 7, 8).

The overall Existing Visual Condition of the area is considered Natural Appearing due to the continuous canopied forest with only occasional existing harvest units or road segments visible from critical viewpoints.

# 3.3.3 Recreation: Affected Environment

## Sense of Place

The South Deep watershed is of mixed land ownership, with the majority of the land administered by the Colville National Forest and containing portions belonging to private landowners, Washington State Department of Natural Resources, and the Bureau of Land Management. The land contains mostly timbered areas that have been managed in the past by small log mills built in the area as a result of the early stand replacement fires of the 1930s and 1940s. Nearby towns include Northport, Colville, Ione, Metaline, Metaline Falls, Kettle Falls, Marcus, Boyds, and Orient. The area holds value for local communities as a historical use area for the Colville and Kalispell Tribes, as a historical homestead area, and as a recreational area.

## Recreation Opportunity Spectrum

The Recreational Opportunity Spectrum (ROS) is used to generally describe the recreational opportunities provided by a specified area. ROS ranges from urban experiences, where recreational opportunities include multiple interactions with people in city parks or trails, to primitive, which are the most remote parts of the forest (USDA Forest Service 1986). ROS is only a description, not a management direction. ROS areas can change over time as forest management directions shift and development occurs.

After comparing the ROS 1985 GIS layer with the management area layer, it was found that the National Forest System land in the South Deep Watershed has three ROS areas; semi-primitive, roaded natural, and roaded modified (Figure 3-12). Areas where the ROS 1985 and Forest Plan direction conflicted were those where semi-primitive non-motorized ROS areas overlapped in MA 5, MA 6 and MA1. MA 5 and MA 6 areas, according to the Forest Plan, can be associated with either roaded natural or semi-primitive motorized. These areas did not meet size and remoteness criteria to be classified as semi-primitive motorized, and therefore they were termed roaded natural. MA1 allows for ROS of semi-primitive motorized or semi-primitive non-motorized. Since the MA1 area did not meet ROS size or remoteness criteria of either semi-primitive motorized or semi-primitive non-motorized, this area is simply termed semi-primitive.

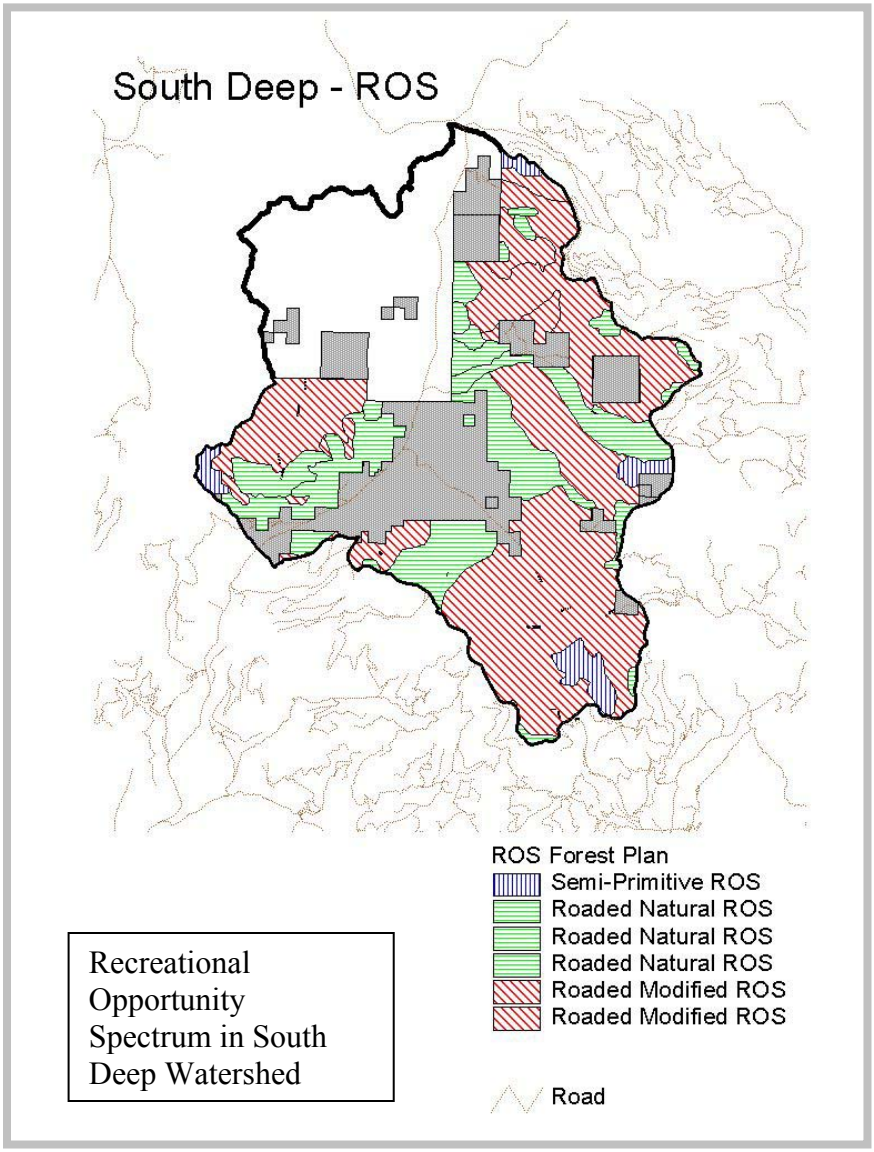



**Figure 3-12. Recreation Opportunity Spectrum, South Deep Watershed**

# Developed Recreation

The South Deep Watershed contains only one developed recreation area, the Big Meadow Lake Campground (Colville National Forest GIS 2003). The campground is used in the spring, summer, and fall and offers multiple campsites, fishing and wildlife viewing opportunities and two developed trails. A homestead replica cabin is within walking distance of the campground. There is a wildlife viewing platform that overlooks a meadow. Portions of trails are barrier free and there is a handicapped-accessible fishing platform. Highest use of the campground is in the summer months, especially on weekends and holidays, but it is also used during hunting season.

# Trails

There are four developed hiking trails maintained by the Colville National Forest within the South Deep watershed (Figure 3-13). Two of these trails, #125 and #120, are around the Big Meadow Lake recreation area and are open only to hiking. A portion of trail #125 is barrier free. This trail leads to a wildlife viewing platform and has a branch trail (unnumbered) that leads to a homestead replica cabin. Trail #120 roughly follows the lake shoreline. Trail #125 and #120 are looped together. Together these trails are 3.8 miles in length.

About 14.6 miles of the Blacktail Butte to Ione snowmobile route is in the southern portion of the South Deep watershed (Figure 3-13). This route, consisting of roads that are not plowed during winter months, is part of a program funded by Washington State Parks and Recreation. Grooming of the route is contracted out by the Washington State Parks and Recreation office to a local groomer and administered by the Tri County Snowmobile Advisory Group. The route is groomed from approximately December 1 to April 30, depending on quality of snowpack (Nielsen, personal communications). This route receives the most use during December through February (Kamstra, personal communication).

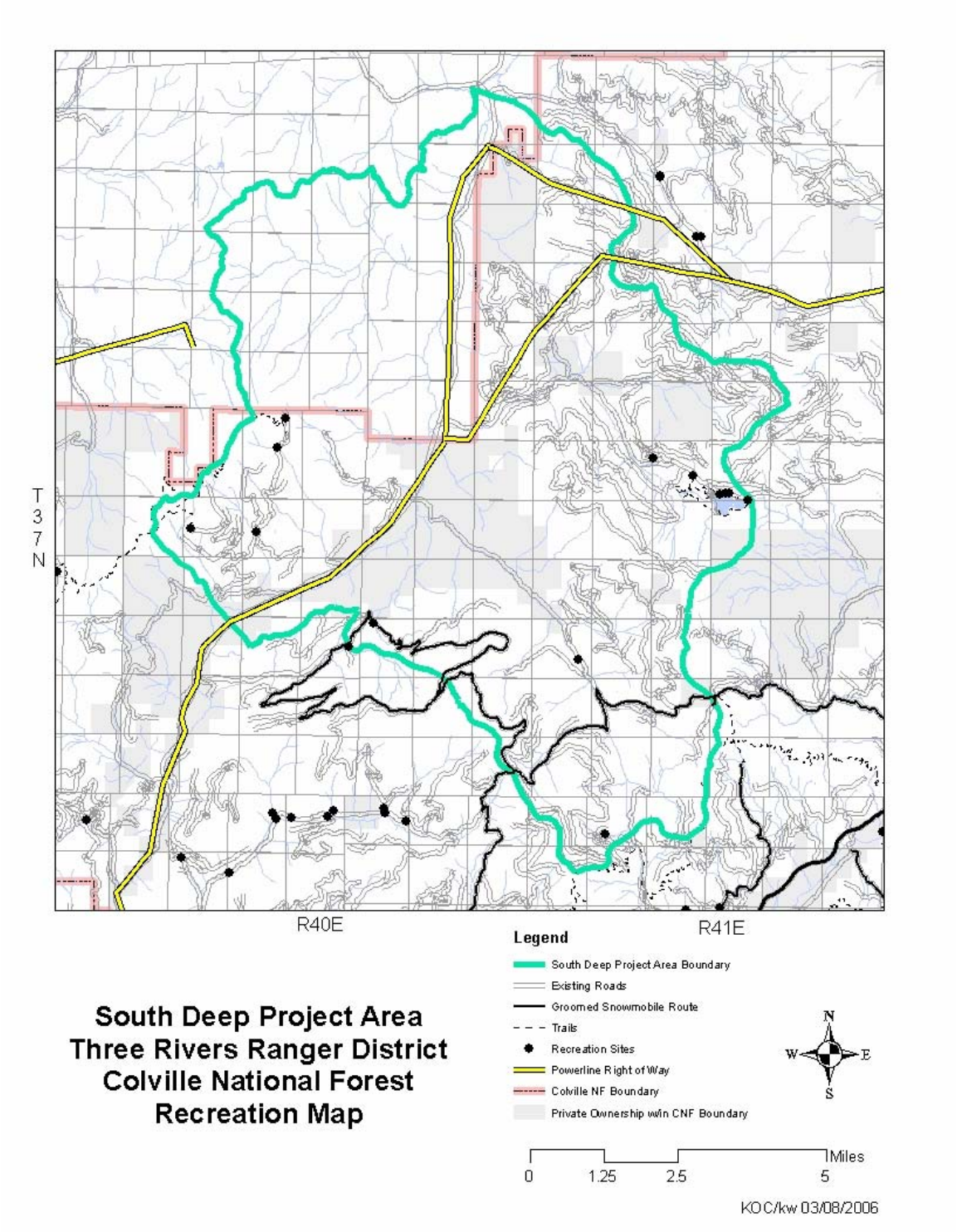
# OHV Use

Use of motor vehicles off of established roads and trails has been identified as a critical issue for national forests and grasslands. To address the issue, a new national rule defining regulations for use of motor vehicles in national forests and grasslands has been developed. The objective of the rule is to protect resources, provide for safety, and to minimize conflicts among multiple users, while maintaining legitimate uses of motor vehicles. Individual national forests are now required to designate which roads and trails are designated as open to motor vehicle use. Other areas will be, by definition, closed to motor vehicle use.

In 2006, off highway vehicles (OHV) are permitted on some of the open roads within and adjacent to the South Deep project area. Additional routes may be designated in future years. The currently designated roads are listed below.

| | | | |
|---|---|---|---|
| 1700200 | 1700290 | 7000635 | 7005570 |
| 1700255 | 7000500 | 7000640 | 7018200 |
| | 7000620 | 7000655 | 7020100 |

**Figure 3-13. Recreation Features, South Deep Watershed**



## Dispersed Camping

There are 12 mapped dispersed campsites in the South Deep watershed (Figure 3.13). The primary use period for these dispersed campsites appears to be during state hunting seasons, but some are also used throughout the summer months.

## Hunting/Fishing

Hunting and fishing are popular activities in the South Deep watershed. Fishing is most common at Big Meadow Lake but occurs throughout the watershed, where accessible. Hunting for big game and birds is popular during the fall and early winter.

## Other Dispersed Recreation

Both local and non-local people use the South Deep watershed for recreational driving and berry, mushroom and firewood gathering. Roads used for recreational driving are generally paved or well-maintained gravel and dirt roads. Individuals participating in recreational driving generally seek the ability to view and experience the forest from a vehicle, with occasional opportunities to stop at interpretive sites or day use areas. Recreationists gathering berries, mushrooms, or firewood can be found throughout the watershed. Specific locations for these activities are difficult to quantify as the availability of these resources changes frequently.

## Cumulative Effects of Past Activities

### *Past Timber Harvest*

Past logging activities have generally created opportunities for greater access to the area for recreational use. There have been short term impacts to visual quality during logging and thinning operations, which has been offset by the long term health of the timber stands viewed by the recreating public.

### *Road Construction*

Forest Service roads created during past activities have increased road densities allowing the recreating public greater access to the forest for hunting, camping, winter recreation, and driving for pleasure. This area is popular among recreationists from the local communities and the increased road access has had a positive effect on motorized recreation.

# 3.3.4 Range Resources: Affected Environment

The South Deep project area contains all or portions of four grazing allotments equaling 20,310 acres on National Forest System lands within the watershed. Including private land, these grazing allotments cover approximately 45,000 acres inside and outside the watershed. The season of use is June 1 thru Oct. 15, and the stocking rate for three allotments combined is 250 cow/calf pairs, while a forth allotment remains vacant. Changes in grazing were identified in the Aladdin Complex Environmental Assessment and decision, completed in July 2005. These changes will be implemented through new Allotment Management Plans. The three active allotments are authorized under 10-year grazing permits through 2012.

The majority of the Smackout allotment (totaling approximately 15,000 acres) is located north and outside of the South Deep project area. However, about 2,120 acres occurs within the project area and encompasses a portion of Little Smackout Creek. The pastures are managed on a rest rotation grazing system and the current assigned use is 156 cow/calf pairs. A vegetative condition and trend analysis completed in 1980 listed 83% of the range in good condition and 16% in fair condition. Improvements on the Smackout Allotment are 11.4 miles of fence, two troughs, and one corral. Table 3-12 describes the improvements in the South Deep project area.

The Meadow Creek allotment is located entirely within the project area (11,675 acres). This allotment is located in the eastern portion of the South Fork of Deep Creek watershed, and contains several smaller nested subwatersheds: Miller Creek, Byers Creek, Upper and Lower Meadow Creek, and a couple of small unnamed 1st order subwatersheds. It is divided into two pasture areas, Paradise Valley which also has the fenced Paradise Meadow, and Byers/Meadow Creek. These pastures are grazed on a rotation system and the assigned capacity for this allotment is 61 cow/calf pairs. Improvements on Meadow Creek Allotment are 7.2 miles of fence (See Table 3-12). A 1980 range analysis indicated that 89% of the range was in good condition, 10% was in fair condition, and 1% was in poor condition.

About 6,380 acres of the Aladdin allotment (totaling approximately 18,000 acres) is located within the South Deep project area. This allotment is located in the southern part of the South Fork of Deep Creek watershed and the northern part of Mill Creek watershed. Clinton/Kolle Creek, Rogers Creek, Scott Creek, Kenny Creek, and Rabbit Creek are tributaries of the South Fork of Deep Creek. Cy Creek, Marble Creek, Strauss Creek, and the North Fork of Mill Creek are tributaries of Mill Creek. Two pastures, Rogers and North Fork Mill, are managed on a rotation grazing system and the current assigned use is 33 cow/calf pairs. Improvements on the Aladdin Allotment are 0.6 miles of fence and 2 water troughs. See Table 3-12 for improvements in the South Deep project area. Data collected in 1977 indicated that 93% of the range was in fair condition.

About 132 acres of the Gillette Mountain allotment is within the South Deep project area. The allotment is vacant and is to be closed with the next Forest Plan revision. There are no range improvements associated with this allotment.

Rocky Creek drainage does not contain an active grazing allotment.

In the Meadow Creek allotment, the cattle fence around the campground and wetlands below Big Meadow Lake has, until recently been maintained by the Forest Service. It has not been maintained during the last few years due to budget reductions. As a result cattle are beginning to impact soil and water resources in this area.

**Table 3-12. Existing Range Improvements in the South Deep project area**

| Improvement | Location | Description |
|---|---|---|
| **Aladdin Allotment** | | |
| Kolle water development | T37N R40E S 10 SW | 1 trough |
| **Meadow Creek Allotment** | | |
| Paradise/Byers division fence | T38N R41E S 25NW, S 26 E | 1.0 mile |
| Meadow Cr.- Ione Hill boundary fence | T38N R41E S 21 W, S 28 W | 1.0 mile |
| Meadow Cr.-Smackout boundary fence | T38N R41E S 24, S 25<br>T38N R42E S.30 | 1.25 miles |
| Byers Cr. drift fence | T38N R41E S.26 SWSE, S.35 NWNE | 1.2 miles |
| Meadow Cr. drift fence | T38N R41E S.35 NWNW | 0.25 mile |
| Paradise Meadow fence | T38N R41E S.15 SE | 1.5 miles |
| Meadow Lake drift fence | T37N R42E S.6 SE, S.7 NE | 1.0 mile |
| Big Meadow Lake fence | T37N R42E S.6, S.7<br>T37N R41E S.1, S.12 | |
| **Smackout Allotment** | | |
| Powerline drift fence | T38N R41E S.10 NW | 0.5 mile |
| Smackout/Meadow Cr. boundary fence | T38N R41E S.14, S.23, S.24 | 1.25 mile |

## Cumulative Effects of Past Activities

Past timber harvest activities have had a positive effect on grazing on these allotments. Timber harvest created openings in the forest which temporarily provided additional forage for livestock. When this transitory range is available, it reduces grazing pressure on primary and secondary range. Greatly reduced timber harvest levels (as compared to ten years ago) plus the switch from even age timber management to uneven age management has reduced the amount of openings in the forest and the resulting available forage.

Long term traditional livestock use of quality forest and rangelands are being adversely impacted due to the encroachment of unpalatable, undesirable and competitive plant species. Plant diversity may be compromised over the long term. This is primarily due to the ability of noxious weeds to effectively compete with more palatable plants for nutrients, space and water. Noxious weeds in these allotments have been found primarily around soil disturbance sites, travel corridors, and homestead meadows, and are known to infest approximately 421 acres of the analysis area. Weeds of primary concern are plumeless thistle, orange and yellow hawkweeds, and diffuse and spotted knapweed.

# 3.3.5 Mineral Resources

No current mineral resource production is occurring from the South Deep Project area except for locally-derived sand, gravel or aggregate used for road maintenance, some road construction and other uses by private, county and federal parties.

The Forest Service is mandated to protect mining claim location corners and improvements, and to continue to provide reasonable access to claims under the 1872 Mining Law (Forest Plan, p. 4-56). Mining activities in the South Deep Planning Area are currently small and sporadic. A search of Department of Interior, Bureau of Land Management, Mining Claims Action Report for the Spokane District indicates that there are currently 9 active claims within the planning area. Most

of these (6) are located in the Rocky Creek drainage. A listing of all claims in this database is shown in Table 3-13.

**Table 3-13. Mining Claims**

| Claim | Tnshp | Rng | Sctn | | Claimant(s) | Last Assessment | County |
|---|---|---|---|---|---|---|---|
| Rocky Creek #1 | 37 | 41 | 25 | NW1/4 | McNamee, Cory J. | 9/2/2003 | Pend Oreille |
| Rocky Creek #2 | 37 | 41 | 25 | NW1/4 | McNamee, Cory J. | 9/2/2003 | Pend Oreille |
| | 37 | 41 | 26 | NE | | | |
| Rocky Creek #3 | 37 | 41 | 25 | NW | McNamee, Cory J. | 9/2/2003 | Pend Oreille |
| | 37 | 41 | 26 | NE | | | |
| Rocky Creek #4 | 37 | 41 | 25 | NW | McNamee, Cory J. | 9/2/2003 | Pend Oreille |
| | 37 | 41 | 26 | NE | | | |
| Kelly Ann | 37 | 41 | 4 | NW | Hazard, Donald R. | 9/2/2003 | Stevens |
| Nona Ray | 37 | 41 | 4 | NW | Hazard, Donald R. | 8/15/2002 | Stevens |
| Russelle Marie #1 | 37 | 41 | 4 | NW | Hazard, Donald R. | 8/15/2002 | Stevens |
| Wilkerson #1 | 37 | 41 | 21 | SE | Caufield, Rodney N. | 8/1/2003 | Stevens |
| | | | | | Crumley, Samuel E | | |
| Wilkerson #3 | 37 | 41 | 21 | SE | Caufield, Rodney N. | 8/1/2003 | Stevens |
| | | | | | Crumley, Samuel E | | |

# Cumulative Effects of Past Activities

Mining has played an important role in the Colville area since the mid-19$^{th}$ century first with placer mining and then with hard rock mining (South Deep Watershed Analysis 1999). Historic mineral production in the South Deep project area includes zinc, lead, silver, gold, copper, molybdenum, tungsten and marble from 14 mines. Substantial production originated from the Vanstone mine (+2.2 million tons) in the Onion Creek drainage and the Sierra Zinc mine (0.9 million tons) in South Fork Deep Creek, both just outside of the Forest Service boundary. Numerous other prospects and small mines are known in the region.

Past activities in the project area include homesteading, timber harvest, livestock grazing, roads, electrical transmission lines, rock pits, hardrock mines, and recreation. These activities are well described under the Soils section. Generally, any activity that brings people close to the ground increases the potential for the discovery and utilization of mineral resources. Activities such as timber harvest and homesteading often provide better access to lands for prospectors and potential miners. These activities may also disturb or destroy former access routes to the mines, the actual mineral workings, and developments or other showings. The result is reduced availability of mineral locality and inventory information. Roads and other developed sites reduce the mineral resource land base by defacto or actual withdrawal of the affected lands from mineral entry. Public expectations associated with the establishment of some developments and uses, such as recreation, may result in future conflicts with potential mineral development. Perceived conflicts can delay or prevent future mineral utilization. Historic mine production and Forest Service mineral material use or sales represent a loss of availability of those specific resources for future use.

## 3.3.6 Costs and Revenues

This subsection identifies the costs and revenues (if any) that are associated with proposals included with the alternatives. Most of the proposals associated with vegetation management, riparian/wetland management, and road management incur costs. The sale of logs that is included in vegetation management proposals is the only activity that would provide revenue.